HAWAII INTEGRATED ENERGY POLICY

December 1991

Envision Hawaii!

Department of Business,
Economic Development & Tourism
Energy Division

FOREWORD

The Hawaii Integrated Energy Policy (HEP) Development Program began in mid-1990 and solicited and incorporated the thoughtful input, comments and recommendations of persons and organizations from throughout the state. Representatives from energy companies, environmental groups, state and county governments, research institutions and numerous concerned citizens all made important contributions to the development of this final report.

Although the HEP process for public involvement was oriented toward building consensus, a complete unanimity of opinion was not possible on all topics. This was also true within the Energy Policy Advisory Committee (EPAC), the committee established to try to synthesize the public input and make recommendations to the Energy Resources Coordinator (ERC). For example, Kauai Mayor Yukimura suggested that 1% of the existing State Fuel Tax be dedicated to the construction and maintenance of bikeways. However, because bikeways are already included in the Transportation Functional Plan, the EPAC recommended against such specific earmarking of the State's Fuel Tax. Another example involved the EPAC not reaching a consensual agreement on the consultants' recommendation to establish a State Department of Energy, based on their institutional analysis. Accordingly, the final decision on the selection of the appropriate institutional option remains for the ERC's consideration.

Every attempt has been made by the Department of Business, Economic Development and Tourism (DBED) staff and the ERC to reflect this diversity of opinion within the report and the comments and recommendations made by individuals. Where this was not possible, the ERC and DBED staff take full responsibility for the omission or possible modification of a particular comment or suggestion.

The final HEP report is not an energy plan for the state. Instead, it presents issues and problems identified during the HEP process and makes recommendations for solutions to these problems. It is worth noting that one of the key recommendations is, in fact, that the state develop a rigorous energy planning process which continues the kind of public involvement established by the HEP process, but does this on a regular basis and utilizing the full range of analytical tools now available for state energy planning. This and other recommendations resulting from the HEP process are now under consideration by the Governor and will either be put forward as proposed legislation or implemented by some other means, e.g., Executive Order.

The HEP Program has been the first attempt by Hawaii to develop a comprehensive state energy policy based on full public participation in the process. DBED views the HEP Program as the beginning, and not the end, of its state energy planning efforts, and plans to use this first endeavor as the foundation for future planning activities.

ACKNOWLEDGEMENTS

The HEP report is the product of hundreds of people's efforts ranging from preparing sections of the report, to participating in the various task forces and work groups, to attending workshops and public review meetings, to filing comments on the report itself. The HEP report is a collaborative response to Hawaii's energy situation and the urgent need to address dependency, security, inefficient and wasteful use of resources, environmental impact, funding and institutional concerns. The combined effort made the report possible and helped shape a vision for Hawaii's energy future. The involvement of numerous agencies, companies, and individuals, whose contribution of time and efforts made HEP possible, is gratefully appreciated.

Gratitude is extended to the members of the EPAC, Integration Group (IG), Energy Emergency Preparedness (EEP) Issues Subcommittee, Enhancing Renewable Energy Development in Hawaii (EREDH) Task Force, and Interagency Role Clarification (IRC) Task Force. Mr. Murray Towill, ERC and Chairman of the EPAC, assumed leadership of HEP mid-stream and forwarded the HEP recommendations to Governor John Waihee. Special thanks are given to the members of the IG for their individual commitment and perseverance throughout the project. In particular we acknowledge the tireless efforts of Mr. Dennis Reeves, IG Chairman. We are also grateful to Dennis for the use of meeting facilities at Pacific Resources, Incorporated. A complete list of the HEP participants can be found in Appendices 1 through 6.

Mr. Maurice Kaya and Dr. John Tantlinger, of DBED - Energy Division, deserve special recognition for realizing the need for improving the current planning and policy making process, reaching out to the "energy community" and concerned citizens for ideas, and directing the HEP process to its completion. John Tantlinger, in particular, served as catalyst to the project by conceptualizing HEP, serving as project manager and staff resource person, and coordinating the involvement of all the participants. Other Energy Division staff deserving recognition include Ms. Vicky Chiu-Irion, Mr. Thomas O'Brien, Ms. Maria Tome, and Ms. Anna Wenz. Thanks also goes to Mr. Steve Burns (Hawaii County), Mr. Kal Kobayashi (Maui County), and Mr. Glenn Sato (Kauai County) for coordinating the involvement and activities with the neighbor islands.

Finally, acknowledgement is given to RCG/Hagler, Bailly and other consultants for assisting DBED - Energy Division throughout the HEP process. RCG/Hagler, Bailly staff included Mr. John Armstrong, Mrs. Jane Enright, Mr. Ray Holton, Mr. William Meade, and Dr. Arun Sanghvi. Consultants included Ms. Kathy Bryant, Dr. Michael Hamnett, Mr. William Sam Pintz, Ms. Dee Dee Letts and the Center for Alternative Dispute Resolution. William Meade, project manager and principal investigator, provided invaluable support to DBED - Energy Division in making HEP a success. His individual contribution to the HEP process included drafting and refining this report, preparing technical presentations for the public review meetings, and facilitating consensus-building at various levels in the project.

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SECTION 1: EXECUTIVE SUMMARY

As the most energy-vulnerable state in the nation, Hawaii depends on imported oil for over 90% of its energy. About half of that oil comes from Alaska and the other half from Asia/Pacific oil producing nations. Both oil production in Alaska and the export capacities of Asia/Pacific sources are projected to decline by roughly 50% by the year 2000. This will likely increase Hawaii's dependence on oil reserves of the politically unstable Middle East region.

Environmental protection is also a major concern for Hawaii and its residents. Energy production from fossil fuels is the major source of local and global air pollutants, while petroleum shipping and handling pose risks to fragile marine habitats and coastal resort areas. An energy policy that internalizes the environmental and social costs of fossil fuels will place added value on energy efficiency and renewable energy, but could result in an increase in the market price of energy to consumers.

Hawaii has a significant, and yet relatively untapped, renewable energy and energy-efficiency resource potential. Biomass, wind, solar, geothermal, hydroelectric, and ocean resources can provide clean, stable sources of energy supply. The islands' energy savings potential is likely to allow utilities to defer the need to construct additional fossil fuel-fired power plants by reducing electricity demand through conservation and increased energy efficiency. Efficiency gains in the transportation sector are also possible.

All of these considerations, coupled with the fact that Hawaii is no less dependent on imported oil today than it was during the first oil crisis of 1973-74, point to the need for the State's government to create a more effective energy policy development and planning process. Hawaii recognized that such a process would have to involve both the general public and the direct representation of Hawaii's "energy community."

1.1 THE HAWAII INTEGRATED ENERGY POLICY DEVELOPMENT PROGRAM

The HEP Program is intended to produce a comprehensive and integrated energy policy designed to facilitate the accomplishment of Hawaii's energy objectives, while establishing a process by which energy policy and planning could be periodically revised and updated. The State's energy objectives are:

1) Dependable, efficient, and economical state-wide energy... systems capable of supporting the needs of the people; and

2) Increased energy self-sufficiency.

Although energy policies are frequently developed or revised in Hawaii, they typically react to specific events (e.g., Arab oil embargo), address a limited aspect of energy use (e.g., tax incentives for residential solar hot water installations), or are not principally intended as an energy policy initiative (e.g., special rates for sugar mills selling excess power to utilities in order to improve the economic viability of the sugar industry). As a result, the current energy policies and programs fall short of taking a comprehensive view of energy in Hawaii.

Hawaii's energy situation is a precarious one (see Exhibit 1). Given Hawaii's overwhelming dependence on a single energy source (petroleum), HEP Program participants recognized that the State must pursue strategies to enhance energy security. Reducing Hawaii's energy vulnerability can be accomplished through the diversification of imported energy sources, as well as the development of indigenous energy sources.

For example, Hawaiian Electric Company (HECO) has taken the position of reducing Hawaii's dependence on oil and diversifying generation sources, such as coal, in the near-term, and renewable energy in the mid- to long-term as renewable energy sources become more cost-effective than conventional generating sources.

In order to prepare an integrated energy policy for the State, DBED - Energy Division structured the HEP Program to give comprehensive coverage to the entire energy field by providing for the broadest possible representation of Hawaii's "energy community" in the process. A task force organizational structure and process were designed to accomplish the program goal and objectives. Individual components of the HEP Program covered the following functional areas: (1) electric and gas utility resource planning; (2) renewable energy and energy efficiency development; (3) transportation energy use; (4) energy emergency preparedness (EEP); and (5) institutional needs and capabilities.

The HEP process included 57 individuals representing 34 participating agencies and organizations that served on the various HEP Task Forces.[1] These groups consisted of: federal, state and county government officials; regulated energy utilities; oil companies; private developers; environmental groups; and university and private energy researchers. A key contributor to the HEP process was the Hawaii Public Utilities Commission's (PUC) Integrated Resource Planning (IRP) Docket; the majority of its 25 parties participated in a collaborative process that recommended IRP principles and objectives, and, on an individual basis, testified on issues raised in the IRP Docket. Also, the 1989 Enhancing Renewable Energy Development in Hawaii Workshop with its state-wide energy questionnaire survey, and the series of HEP public review meetings conduced in July and August 1991 enabled hundreds of energy-conscious Hawaii residents to participate in the HEP process.

The HEP process is managed by the State ERC, Hawaii's Director of Business, Economic Development and Tourism, with advice from the EPAC (see EPAC listing for membership). Chapter 196 of the Hawaii Revised Statutes (HRS) gives the ERC ultimate responsibility for the State's energy management activities and serves as the statutory authority upon which the HEP Program is based. While drawing on the experiences and innovative approaches of other states, it is believed that the HEP process makes Hawaii unique because of its open, consensus-building approach to public energy policy development.

[1] The HEP Program participants volunteered over 3,000 hours (1.5 person years) of their time to this effort in 1990-1991.

EXHIBIT 1: Energy Trends in Hawaii

The uncertain future of the sugar industry has implications for Hawaii's long term energy supply. Sugar mills currently provide 8% of the State's gross electricity generation (and as much as 44% on Kauai).

Historically, Hawaii has lead the nation in vehicle fuel efficiency, but the fuel consumption of vehicles in the State has been static over most of the last decade. This pattern is in sharp contrast to the U.S. as a whole, where fuel efficiency has been steadily improving.

Current sources of imported oil will decline dramatically over the decade. Alaska's North Slope production is expected to decline by 50%, and the Asia/Pacific output will drop from 2 million barrels per day to 814,000 barrels/day by the year 2000.

Growing public concern for environmental quality will result in increases in the cost of fossil fuel-based energy. Some estimates of the indirect costs associated with conventional energy sources are more than double current market prices.

Today's real cost of oil, adjusted for inflation, is approximately the same as it was in 1974, despite sharp price increases experienced during the interim. Private investments will continue to be based on low oil price assumptions for the future.

Continued economic development centered in Honolulu will increase traffic congestion, commuting time, and ground transportation energy demand on Oahu. Vehicle density per mile of public road has grown 63% since 1973. Oahu has 70% of the registered vehicles in the State, while only 36% of total public road mileage.

Renewable energy systems stand at varying degrees of commercial readiness. The cost of energy from hydroelectric systems, biomass, cogeneration, and solar hot water systems has stabilized. Improvements in wind, biomass conversion, photovoltaic (PV) systems and other technologies will make these systems more cost-effective over the decade.

Current state energy funding sources cannot be sustained. Over half of the State's annual budget for energy comes from the Petroleum Violation Escrow (PVE) account. At the current rate of expenditures, the PVE account will be exhausted by 1994.

1.2 HEP PROGRAM OBJECTIVES

During the first iteration, the HEP Program established a broad set of objectives covering the various aspects of energy supply and demand. The program objectives are to:

1) **Facilitate the adoption of IRP procedures by Hawaii's energy utilities.** Historically, utilities have had the sole responsibility of preparing long-range forecasts of customer energy needs and selecting the energy resource(s) to meet the expected demand. Through an IRP approach, the HEP Program provides a more systematic review of resource options and provides interested parties with an opportunity to have input in resource selection.

2) **Identify and address the State's institutional issues as they relate to energy management.** Numerous federal, state and county government agencies, as well as private organizations, are involved in the various aspects of energy development in Hawaii. By reviewing the institutional issues and the inter-organizational relationships, the HEP Program recommends an institutional structure that better ensures the achievement of State energy objectives, while removing unnecessary redundancy and allocating human and financial resources more efficiently.

3) **Recommend actions to enhance renewable energy development and energy efficiency.** Given Hawaii's dependence on imported oil and its relatively untapped renewable energy and energy efficiency potential, the HEP Program recommends specific actions to increase Hawaii's energy self-sufficiency.

4) **Integrate and coordinate energy emergency preparedness plans and procedures.** The need to prepare for energy emergencies was illustrated following the energy crises of the 1970s, and further reinforced by Iraq's invasion and occupation of Kuwait in 1990-1991. As oil production from Hawaii's traditional supply sources (i.e., mainland U.S. and the Asia/Pacific region) shift to the politically volatile Middle East over the next decade, the HEP Program incorporates both preparatory and response strategies to disruptions in imported oil supplies.

5) **Broaden participation in energy policy development by the widest possible range of "energy stakeholders."** The HEP Program recognized the need to incorporate the interests of all of the parties affected by energy decisions early in the process of energy decision making. The HEP Program, through its task force structure and public input and review opportunities, established a process for developing a balanced energy policy with broad public support.

6) **Assess energy efficiency and diversification opportunities in the transportation sector.** Energy use in Hawaii's transportation sector (i.e., air, marine and ground) is affected by federal and state policies, as well as individual decisions by the providers of transportation services and vehicle owners. The HEP Program recommends state transportation initiatives to meet the objectives of providing efficient transportation services and managing the use of petroleum products.

1.3 MAJOR FINDINGS

The research and analysis conducted in the HEP Program revealed that no single energy policy can address Hawaii's complex energy situation. Managing the supply, delivery and use of energy in Hawaii requires an understanding of current energy use patterns, opportunities and limitations in changing those patterns to meet State energy objectives, and identifying the appropriate role for State government in effecting desired changes. The major findings of the HEP Program are:

1) **There is a need to address institutional responsibilities and requirements in State energy management and development.** On the one hand, there is only limited energy planning capability within state or county governments. On the other hand, 17 agencies and statutory bodies are responsible for 46 State and 38 County government permits and approvals that may be required for the development and siting of energy facilities such as conventional power plants, wind farms and hydro-electric plants. The complex system of permits and approvals can require up to seven years for a single project. If Hawaii is to achieve its energy objectives, the State needs to provide greater leadership, better coordination of energy activities, and clearer policy direction.

2) **Hawaii's extensive renewable energy research and development activities are not being conducted within a coordinated and comprehensive framework.** Numerous public and private institutions receive state funding to advance the commercial status of renewable energy and energy efficiency. However, there is limited coordination, and in some cases overlap of responsibility, among these institutions' activities. Moreover, many alternative energy technologies have not progressed beyond the demonstration stage. If renewable energy technologies are to make a significant impact in Hawaii, better coordination of funds and activities is needed. Grid-connected technologies need electric utility involvement to determine the feasibility and compatibility with existing systems.

3) **Energy conservation and improved energy efficiency deserve greater emphasis in development of Hawaii's indigenous resources.** Reducing unnecessary energy use may represent the most cost-effective and socially and environmentally acceptable resource option in all sectors. These sentiments were underscored by participants in the HEP public review meetings.

4) **Hawaii's vulnerability to oil supply disruptions will increase over the decade.** Current sources of imported oil are expected to decline over the next ten years. This will result in a shift away from politically stable sources in the U.S. and Asia/Pacific to the unstable Middle East region. At this time, the State remains extremely vulnerable to supply disruptions.

5) **The State must expand its energy policies to include the transportation sector.** Past efforts to diversify energy supply away from oil have focused almost exclusively on the production of electricity. At the same time, the transportation sector accounts for nearly two-thirds of all petroleum use.

6) **Hawaii is as dependent on imported oil now as it was in 1974 when its policy of energy self-sufficiency was established.** The cost of oil, the benchmark for most energy-efficiency alternatives, has fluctuated dramatically in the past two decades. However, in real terms, the price of oil is now at the same level it was in 1974. Renewable energy technologies would, undoubtedly, be contributing more to Hawaii's energy needs if the price of oil were consistently higher and/or if cost accounting systems were applied that considered the life-cycle costs (environmental, economic, social, etc.) of all of Hawaii's energy resource options. Internalizing the environmental and social costs of fossil fuels will place added value on energy efficiency and renewable energy, but could increase the price to consumers. The HEP Program is the first attempt to address the complex interrelationships of energy production and use in Hawaii in developing a state energy policy.

1.4 PRINCIPAL RECOMMENDATIONS

The HEP Program resulted in the development of numerous proposed policy initiatives and specific project activities, with corresponding assignments of lead and support implementation responsibilities, and an estimate of the appropriate time frame (i.e., near-term, mid-term, long-term) for their implementation. A preliminary cost/benefit assessment was prepared for each initiative. The principal policy recommendations that emerged from this first iteration of the HEP Program are:

1) **Create a new energy agency, with the intent of increasing the stature of, and administrative emphasis on, energy activities.** The new agency should have primary responsibility for conducting energy planning and policy development, establishing priorities and overseeing energy research and development programs, and working to improve the efficiency of and facilitating the permitting process without compromising environmental and other standards.

2) **Prepare and publish a biennial Hawaii Energy Plan to replace the Energy Functional Plan.** The Hawaii Energy Plan should contain specific policy recommendations and budgetary requests. It should integrate the analysis and findings of several component efforts, including the Energy Emergency Preparedness Plan, the Long Range Energy Supply/Demand Forecasts, the Energy Technology/Resource Assessment Report, the Comprehensive Research, Development and Commercialization Strategy, and the Energy Conservation Plan. An EPAC should review and provide input to the Hawaii Energy Plan. The public should have ample opportunity to also provide their input through formal and informal processes.

3) **Amend the Hawaii State Plan, HRS Section 226-18, to include an additional objective to "ensure energy security" and an additional policy to "promote alternate fuels and energy efficiency by encouraging diversification of transportation options and infrastructure."** In addition, all references to power systems should be broadened to include all energy systems. These changes more closely reflect the structure of the HEP Program and the energy use patterns of the State.

4) **Prepare and publish a comprehensive renewable energy and energy efficiency research and development (R&D) strategy with specific resource assessment, basic and applied research, and commercialization and implementation activities.** For each resource and/or technology, the R&D plan should articulate the specific activity and cost of all the steps necessary to reach commercial status, including the development of financial incentives that will make renewable energy more cost-effective in the near term. In the process, Hawaii should increase its efforts to draw on the experience of other states. The strategy should feed into long-range energy planning and guide R&D efforts in Hawaii.

5) **Analyze the effectiveness of transportation policy options, including public transit, energy pricing and other fiscal policies, and infrastructure changes, that will reduce demand for petroleum based fuels.** This initiative should incorporate ground transportation in energy planning and policy development.

The matrices that follow list the complete set of HEP recommendations. They are divided by category, with a description of the objective and specific initiative. Preliminary estimates are given in terms of initial and recurring costs. The costs represent the best estimates available from the HEP participants and consultants. Cost estimates will be revised, as necessary, in the legislative process.

DBED - Energy Division organized and conducted a series of public review meetings throughout Hawaii with assistance from numerous HEP task force members to present the draft HEP findings and recommendations. In general, the report was favorably received, although the public was skeptical of the State's willingness to implement or act on the recommendations, based on the state's historical inability to positively affect its energy situation. The public almost universally felt that energy conservation, as a resource, needed far more emphasis in Hawaii, in general, and in the report, in particular. Many of the public's specific comments have been incorporated in the revised HEP report. A summary of comments can be found in Appendix 7.

Section 2 of this report describes energy production and use patterns in Hawaii with some discussion of how those patterns are expected to change over the next decade. Section 3 discusses three cross-cutting issues for energy development: environmental protection; economic development; and security. Section 4 contains the complete list of policy recommendations, divided by functional area. This section gives the reader the context in which the policy is needed and details on the recommended initiative. Section 5 serves as a guide in institutionalizing the HEP Program. Appendices 1-5 list the HEP participants by task force. Appendix 6 lists the parties to the PUC's IRP proceeding (Docket No. 6617).

HAWAII INTEGRATED ENERGY POLICY RECOMMENDATIONS

Category	Objective	Initiative	Cost ($000)
OVERALL STATE ENERGY POLICY AND PLANNING	Significantly increase the stature of, and administrative emphasis given to, energy management capabilities.	Create a new energy agency, with the intent of increasing the stature of, and administrative emphasis on, energy activities.	TBD
	Develop a comprehensive energy strategy that incorporates the efforts of private and public energy planners.	Prepare and publish a biennial Hawaii Energy Plan to replace the Energy Functional Plan.	Init 420 Recur 120
	Explicitly include energy security and transportation energy use in State energy objectives and policies.	Amend the Hawaii State Plan, HRS Section 226-18, "Objectives and policies for facility systems - energy/telecommunications."	None
	Provide a permanent and stable source of funding for State energy programs.	Establish an Energy Program Support Fund.	TBD
	Determine the sensitivity of the local economy to "energy emergency" situations.	Analyze the impact of oil supply disruptions and/or sharp increases in oil prices on the local economy.	Init 150 Recur 50
	Provide a constructive atmosphere for socially- and environmentally-acceptable energy project development.	Establish a range of institutional mechanisms to aid the resolution of conflicts among stakeholders.	None
	Provide objective, comprehensive and consistent information on energy resource options for Hawaii.	Prepare and publish an Energy Technology/ Resource Assessment Report which analyzes the internal/external costs and benefits of different energy options appropriate for Hawaii.	Init 100 Recur 25
INTEGRATED UTILITY RESOURCE PLANNING	Reflect the avoided external costs of conventional energy resource options.	Examine methods to establish and update renewable energy and demand-side management (DSM) preference in utility regulations.	Init 60 Recur 0
	Improve the energy efficiency of government-owned facilities.	Extend utility DSM programs to federal, State and County government facilities.	TBD
	Coordinate and disseminate DSM program information.	Establish a DSM information center.	Init 33 Recur 33

Note: TBD - To be determined; Init - Initial costs (first year or first project cycle); Recur - Recurring costs

Category	Objective	Initiative	Cost ($000)
ENHANCING ENERGY EFFICIENCY AND RENEWABLE ENERGY DEVELOPMENT	Prioritize energy research and development activities in terms of increasing the State's energy self-sufficiency.	Prepare and publish a Comprehensive Renewable Energy and Energy-Efficiency Research, Development and Commercialization Strategy.	Init 70 Recur 20 (for plan only)
	Collect and report cost and performance data on renewable energy installations in Hawaii and elsewhere.	Establish a data base of information upon which to analyze renewable energy options.	Recur 35
	Improve consumer confidence in the operation of renewable energy systems.	Establish guidelines/standards for renewable energy installations with appropriate public input.	Init 62 Recur 12
	Improve the energy efficiency of residential and commercial buildings in Hawaii.	Implement energy efficient building codes being prepared by DBED through hiring building code professionals for each of the counties.	Recur 160
	Maximize the cost-effective alternative energy contribution to State-funded housing projects.	Mandate cost-effective use of alternate energy and energy-efficient domestic hot water for public housing units.	TBD
	Allow professionals to do complete solar domestic hot water and photovoltaic system installations.	Modify license C classification to allow solar professionals to do complete domestic hot water and photovoltaic system installations.	None
	Address land-use constraints to renewable energy installations.	Investigate potential for dual (compatible) and acceptable use of State-owned agricultural and conservation land for siting renewable energy projects.	Init 90
	Minimize the need for solid waste landfills, while considering energy efficiency and energy production opportunities.	Assist the county public works departments to assess the energy implications of solid waste management plans.	TBD
	Evaluate streams for possible hydropower development.	Identify and designate streams and river basins that are suitable for hydropower development.	Init 200
	Increase public awareness and acceptance of alternative energy programs.	Launch a major state-wide energy education program, encompassing the transportation sector.	Init 340 Recur 340

Note: TBD - To be determined; Init - Initial costs (first year or first project cycle); Recur - Recurring costs

Category	Objective	Initiative	Cost ($000)
TRANSPORTATION ENERGY USE	Incorporate the transportation sector into energy planning and policy development.	Analyze use of incentives/disincentives to promote fuel efficiency and alternate energy use in ground transportation; amend HRS 196-4 (ERC powers & duties) to include transportation energy use.	Init 160 Recur 50
	Stimulate government and private efforts to reduce demand for petroleum based fuels in ground transporation.	Form a transportation task force to coordinate demonstration of alternate fuel and energy-efficient vehicles.	Init None Recur TBD
	Support and promote decentralization of private and public services.	Expand "telework" center program and other satellite office facilities.	TBD
	Facilitate commuter ride sharing for government, communities, schools, businesses and hotels/resorts.	Establish commuter information centers to facilitate commuter ride sharing.	TBD
	Expand public transportation services on neighbor islands.	Assist counties of Maui, Kauai and Hawaii in the planning, assessment, development, and/or improvement of public transportation systems.	Init 6,000
	Encourage safe use of non-motorized vehicles as an alternative to automobiles.	Review, upgrade and implement the bikeway program.	Init 300
ENERGY EMERGENCY PREPAREDNESS	Review/update State and county energy emergency plans biennially.	Amend Hawaii revised Statutes, Section 125C.	State Init 25 Recur 200 Counties Recur 120
	Require State and county energy emergency plan coordination and consistency.		Recur 90
	Require development of an energy emergency communications plan.		Init 25 Recur 120
	Require a full-time permanenet energy emergency preparedness staff.		Recur 190

Note: TBD - To be determined; Init - Initial costs (first year or first project cycle); Recur - Recurring costs

Category	Objective	Initiative	Cost ($000)
ENERGY EMERGENCY PREPAREDNESS (continued)	Clarify the administration of the Petroleum Product Control Fund.	Amend HRS, Section 125C.	Recur 500
	Require a permanent facility to house energy emergency preparedness and fuel set-aside staff.		Recur 50
	Establish priority certification of emergency services.	Revise Administrative Rules (HRS, Section 91).	Init 10
	Accommodate eligible commercial accounts without a 12-month operating base.		Init 10
	Increase energy supplies—predetermine waivers that need to be requested.	Review petroleum product specifications.	Init 15
	Allocate jet fuel to designated users in the event of an energy emergency.	Analyze aviation fuels within Set-Aside program.	Init 50
	Reduce uncertainty regarding Hawaii's access to national petroleum stockpiles.	Pursue strategy for priority access to Federal Strategic Petroleum Reserve.	None
	Establish Regional Petroleum Reserve in Hawaii.	Establish Regional Petroleum Reserve.	Init 150,000 (construction costs only)

Note: TBD - To be determined; Init - Initial costs (first year or first project cycle); Recur - Recurring costs

SECTION 2: OVERVIEW OF ENERGY PRODUCTION AND USE

Adequate energy supplies are essential to modern life styles and to economic activities. In Hawaii, energy supplies are highly dependent on imports of petroleum, which account for 92% of the energy used in the State. This imported petroleum is secured in international markets and is vulnerable to political and economic forces beyond the control of the State government.

Since the mid 1960s the world has become increasingly dependent on the countries of the Organization of Petroleum Exporting Countries (OPEC) for petroleum supplies. The major OPEC oil producers are located in the politically unstable Persian Gulf region and control nearly 64% of the world's oil reserves. Exhibit 2 provides current estimates of petroleum reserves, production, and production/reserve ratio[2] data for the world's major oil producers.

EXHIBIT 2: World Petroleum Reserves and Production

Country	% of World Oil Reserves	% of Current Production	Production/ Reserve Ration
Saudi Arabia	25.7%	8.9%	>100
Iraq	10.0%	4.5%	97
United Arab Emirates	9.8%	3.1%	34
Kuwait	9.7%	3.1%	>100
Iran	9.3%	4.7%	89
USSR	5.8%	17.2%	13
Venezuela	5.8%	3.2%	85
Mexico	5.6%	3.9%	56
U.S.	2.7%	11.5%	10
China	2.3%	2.0%	23
Indonesia	0.8%	4.4%	17

Source: *BP Statistical Review of World Energy,* June 1990 and DBED, *Assessment of the Current Middle East Crisis' Impact on Hawaii's Petroleum Situation,* September 1990.

[2] Evaluations of depletable resources like petroleum assess a country's or region's geologic reserves against its current production levels. The resulting ratio of production to reserves measures the years - at current production levels - that currently known reserves can be expected to last. Such measures provide useful insights into future resource availability. This ratio does not consider either the future growth of oil consumption or the future discovery of additional reserves.

In the coming decades as oil reserves are depleted in other oil producing regions, particularly in the major consumption centers of Europe and North America, international dependence on Persian Gulf oil will increase rapidly.[3] As this occurs, the world oil trade will become increasingly sensitive to the oil policies of Persian Gulf nations.

Hawaii's dependence on imported oil mirrors that of the United States as a whole. American oil reserves are being depleted much faster than new oil can be discovered, with the result that America's reserve to production ratio is now one of the lowest of any major world producer. Oil supplies to Hawaii have historically come from Alaska and from producers in the Asia/Pacific region.[4] The future petroleum reserve situation in both Alaska and in Asia/Pacific is not encouraging. Crude oil availability from Alaska's North Slope is expected to decline by about 50% by the year 2000. This decrease will increase oil dependence and will put additional pressure on oil producers in the Asia/Pacific region, where export capacities are projected to decline from about 2 million barrels per day to only about 814,000 barrels per day by the year 2000.[5]

Fortunately, the U.S. possesses substantial resources of both renewable and non-renewable fuels, which can be substituted for many energy uses.[6] The existence of these indigenous fuels will serve to buffer American energy users from the deteriorating oil supply situation. This is illustrated in Exhibit 3, which compares U.S. and Hawaiian energy supply in 1990.

Although coal and natural gas are important ingredients in the U.S. energy picture, neither represents a sizable share of Hawaii's energy supply. Hawaii has no indigenous fossil fuel resources, and developing the infrastructure for using non-oil fossil fuel imports is expensive. However, as a means of decreasing its dependence on oil, HECO has agreed to purchase coal-generated electricity beginning in 1992. The utility is considering additional coal-fired generating capacity later in the decade. Similar plans are under discussion for the island of Maui.

2.1 DEMAND FOR ENERGY IN HAWAII

Although Hawaii's economy has grown substantially during the last decade, its primary economic structure has remained substantially the same. This structure is dominated by tourism (chiefly using aviation fuel, electricity, and ground transportation), the military (whose chief energy needs are for aviation fuel and electricity), and agro-processing (which contributes to electricity supply through use of sugar bagasse as a boiler fuel).

[3] It should be noted that the U.S. is the largest single oil consuming nation, accounting for over one-quarter of the world total.

[4] Hawaii's refineries are designed to maximize yields of jet fuel, limiting supply sources to producers of light crude oil.

[5] Yamaguchi, N. and Issak, D., *Hawaii and the World Oil Market: An Overview for Citizens and Policymakers.* East West Center Energy Program, September 1990 and estimates from Pacific Resources, Inc.

[6] Meridian Corporation. *Characterization of U.S. Energy Resources and Reserves.* Prepared for the Deputy Assistant Secretary for Renewable Energy, U.S. Department of Energy, June 1989.

EXHIBIT 3: Comparison of U.S. and Hawaiian Energy Supply (1990)

Source	U.S. Trillion Btu	Percent	Hawaii Trillion Btu	Percent
Coal	19,094	23.5%	0.9	0.3%
Natural Gas	19,409	23.8%	–	0.0%
Petroleum	33,553	41.2%	295.4	92.0%
Nuclear	6,186	7.6%	–	0.0%
Hydroelectric	2,944	3.6%	1.1	0.3%
Other*	207	0.3%	23.8	7.4%
Total	**81,393**	**100.0%**	**321.2**	**100.0%**

* Includes biomass, waste, geothermal, solar and wind energy sources.

Source: U.S. Department of Energy, Energy Information Administration and DBED - Energy Division.

Hawaii's economic base is substantially different from the economic base that exists in the rest of the U.S. In 1988, total energy expenditures were 7.7% of Gross State Product (GSP) for Hawaii, while national energy expenditures were 8.3% of Gross National Product (GNP).[7] Exhibit 4 illustrates the ratio of energy consumption to GSP in constant ($1982) terms for the period 1960-1988, showing that the energy intensity of Hawaii's economy has steadily declined since 1961. However, 1988 marked the third-largest annual increase in energy intensity after 1961 and 1967. Hawaii has relatively low per capita energy consumption, ranking 44th in the U.S.[8]

Transportation is the largest energy consuming sector in Hawaii, accounting for 63% of petroleum use and 57% of total energy consumption.[9] The principal difference between Hawaii and the U.S., as a whole, is jet fuel consumption. Jet fuel accounts for 42% of Hawaii's petroleum consumption versus only 9% for the U.S. This is attributable to Hawaii's geographic location as a tourist destination and refueling site for trans-Pacific flights.

Electricity demand in the State is heavily concentrated on Oahu, where over three-quarters of the population live. In 1990, electricity sales on Oahu accounted for 78% of the State total.[10] Households comprise 80% of total customers (i.e., meters), however, the residential sector accounts for only 30% of total electricity

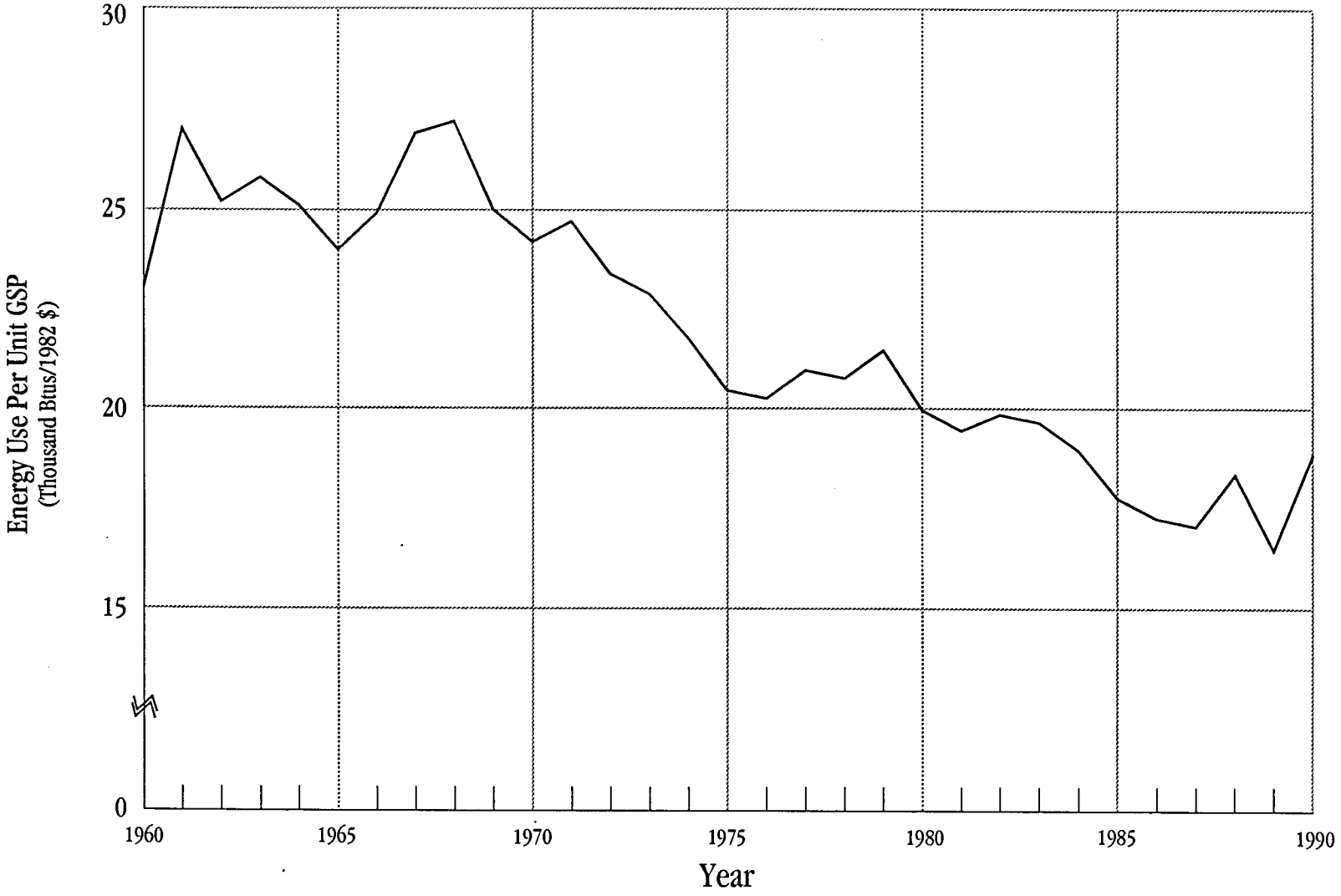
[7] Hawaii data provided by DBED - Energy Division; national data provided by the U.S. Department of Energy, Energy Information Administration.

[8] Public Citizen. *Energy Audit: A State-by-State Profile of Energy Conservation and Alternatives,* October 4, 1990.

[9] DBED - Energy Division, *Assessment of the Current Middle East Crisis Impact on Hawaii's Energy Situation,* September 1990.

[10] *The State of Hawaii Data Book - 1990,* Table 486, November 1990, p.432.

EXHIBIT 4: Energy Consumption and Constant GSP in Hawaii
(1960 - 1990)



Source: U.S. Department of Energy, Energy Information Administration, and DBED.

sales in the State. These numbers hide the fact that as a percent of total island electricity sales, residentialthat consumption on the islands ranges from 26% on Oahu to as much as 41% on Molokai. It should be noted the agricultural sector (particularly the sugar industry) supplies much of its own thermal and electrical energy needs.

While electricity dominates non-transportation energy demand, a small but growing alternative is gas. In addition to liquid fuels, Hawaii's oil refiners produce propane and synthetic natural gas (SNG) from imported crude oil.[11] These products are distributed as a utility fuel through pipelines in major urban areas and as non-regulated bottled gas to consumers throughout the State (91% of the utility gas is distributed on Oahu). Propane/SNG is used by a wide variety of customers, ranging from hotel/restaurant cooking and water heating to cement manufacture and coffee drying. About 17% of utility gas sales in Hawaii are to residential customers who use gas for cooking and water heating.

2.2 SUPPLY OF ENERGY IN HAWAII

Hawaii's energy supply has come primarily from petroleum imports over the past two decades, despite a strong State commitment to greater energy self-sufficiency (see Exhibit 5). Although lacking fossil fuel resources, the State does possess substantial but largely undeveloped geothermal, wind, biomass, ocean and solar energy resources. While no definitive inventory of these renewable resources has been made, it is clear that they are adequate to make a substantial contribution towards reducing Hawaii's oil requirements.[12]

The barriers impeding the greater use of local renewable energy resources are substantial and include the high proportion of energy consumed as liquid fuels by the transportation sector. With the exception of alcohol fuels derived from local biomass sources that are used as a substitute for or blend with gasoline for ground transportation use, most liquid fuels are not easily amenable to substitution by renewable energy resources.

As mentioned earlier, petroleum provided 92% of Hawaii's total energy supply in 1990. This has grown from 90.5% in 1980.[13] Biomass, the second-largest source of energy supply, declined from 8.8% to 6.6% of total supply over this period, which included the start-up of a municipal solid waste project on Oahu. The contribution from solar hot water heating has nearly tripled during the 1980s, providing 0.7% of total supply in 1990. Hydroelectricity has maintained its relative share of total supply, accounting for 0.3% of the total. Wind energy supply peaked in 1987 reaching just 0.3% of the total. It currently supplies less than one-tenth of one percent of the total.

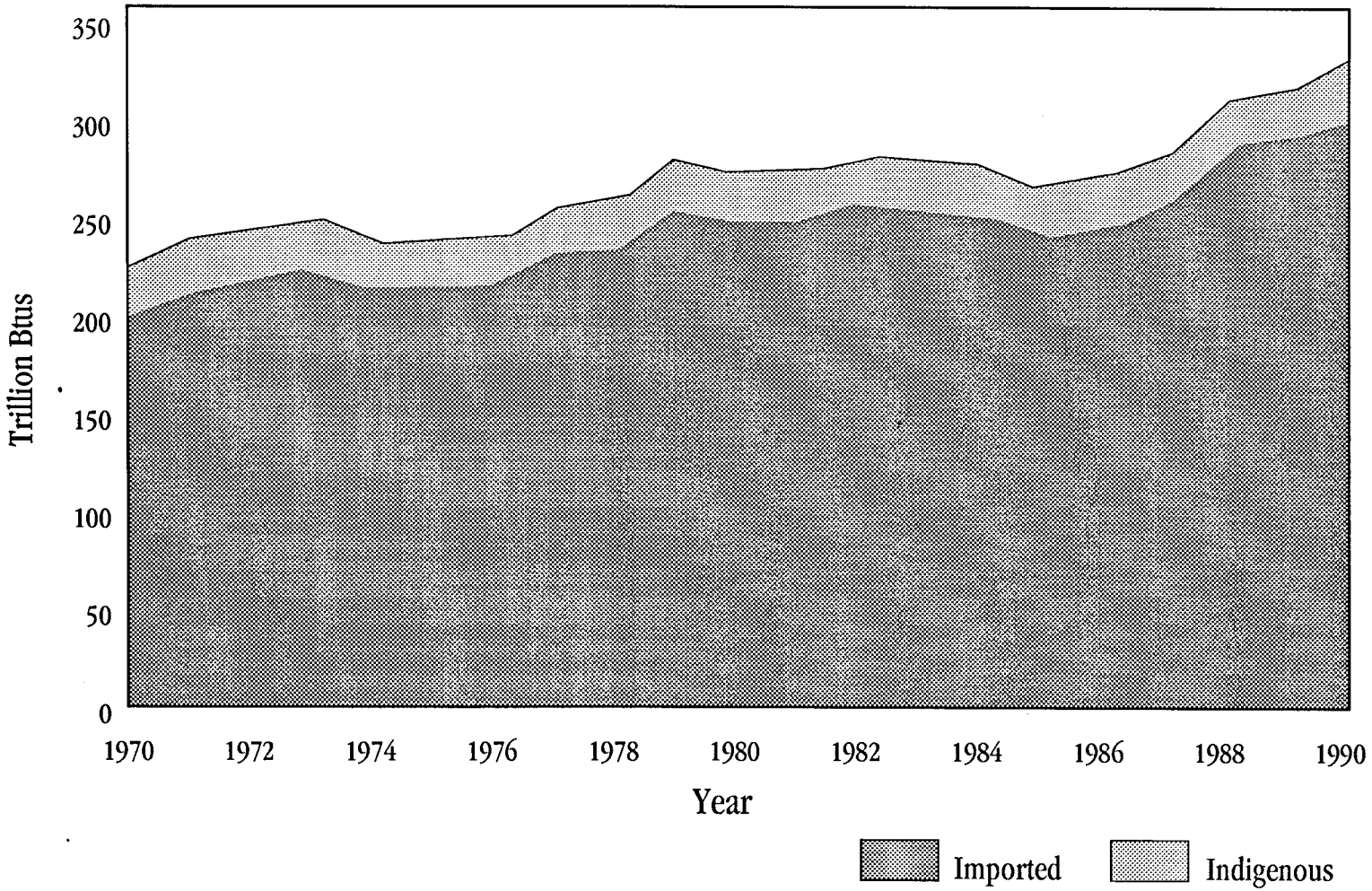
The State currently imports both crude oil for local refining and already refined petroleum products from the U.S. mainland and Asia/Pacific region. About 66% of foreign crude oil and over 90% of the foreign refined product imported to Hawaii originate from Indonesia, Malaysia and Singapore. Alaska currently provides all of Hawaii's domestically supplied crude oil. Hawaii's refineries export small volumes of surplus

[11] Approximately 15% of the propane gas distributed in Hawaii is directly imported.

[12] Lawrence Berkeley Laboratory. *Hawaii Integrated Energy Assessment,* January 1981.

[13] *State of Hawaii Data Book -1990,* Table 480, November 1990, p. 427.

EXHIBIT 5: Imported and Indigenous Energy Supply



Source: U.S. Department of Energy, Energy Information Administration and DBED.

petroleum products to both the mainland and the Asia-Pacific region. Hawaii exports refined petroleum products to East Asia and South Pacific countries. These exports mainly consist of high sulfur residual oil and naphtha for which there is currently no market. Exhibit 6 shows the import-export balance of petroleum and petroleum products in Hawaii for the 1989/90 period, while Exhibit 7 illustrates the movement of petroleum to Hawaii.

EXHIBIT 6: Import and Export of Petroleum from Hawaii (1989/1990)

Thousands of Barrels Per Year (average)						
Source	**Crude**	**Gasoline**	**Diesel**	**Jet Fuel***	**Fuel Oil**	**Other**
Imports	43,720	12	849	2823	4022	151
Domestic	17,631	12	849	1022	2893	151
Foreign	26,089	0	0	1801	1129	0
Exports	36	101	4709	85	1658	1904
Domestic	0	101	3972	85	633	1333
Foreign	36	0	737	0	1025	572

* Does not include independent imports by commercial airlines.

Source: *State of Hawaii Data Book - 1990* and DBED - Energy Division.

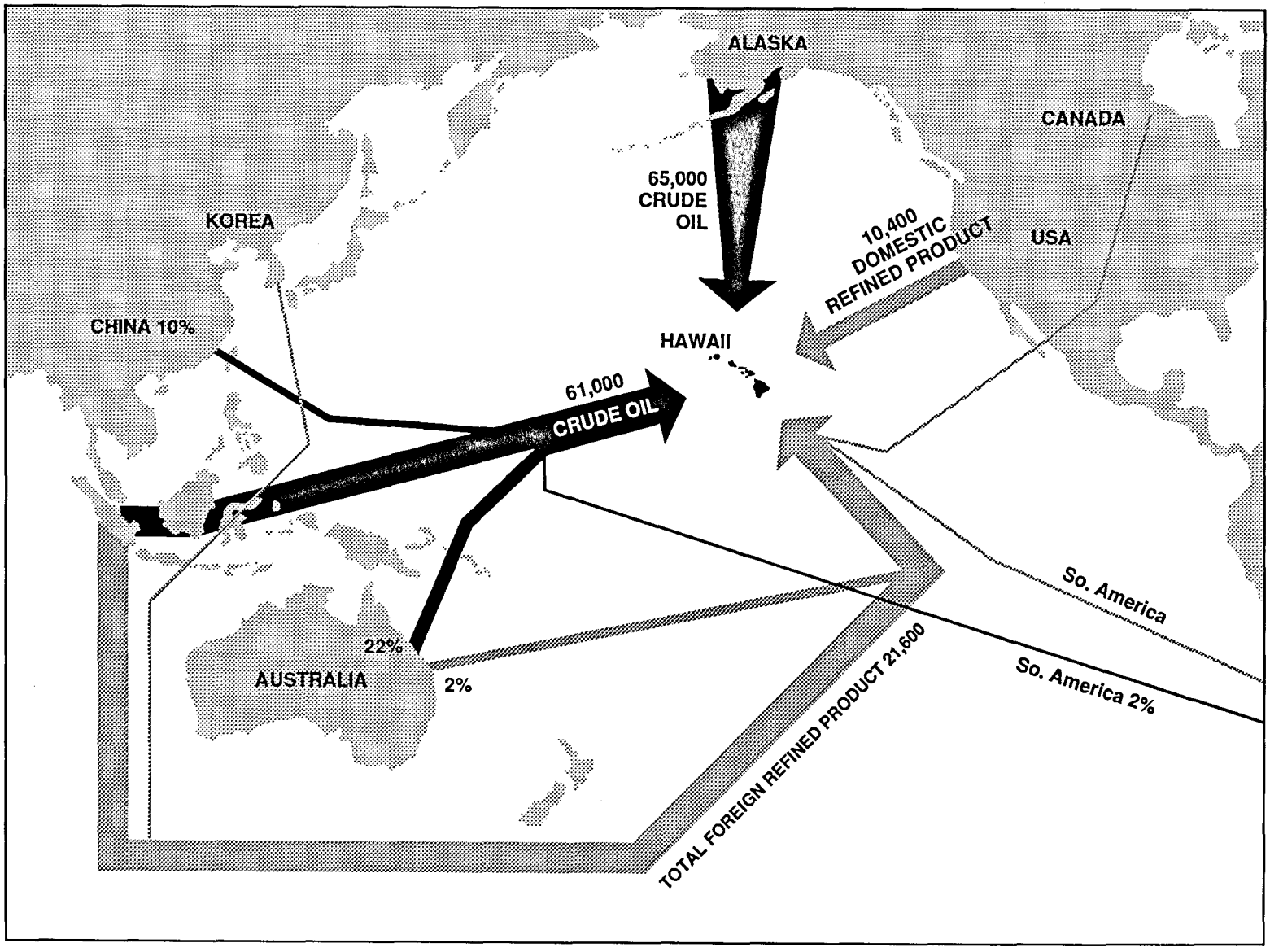
2.3 COUNTY/ISLAND ENERGY COMPARISONS

In considering specific strategies to decrease petroleum dependency and improve energy self-sufficiency, it is important to understand the differences among the islands and counties. Indeed, while the State of Hawaii is the most oil-dependent state in the nation, some of the islands have made major progress toward increasing self-sufficiency in their electrical generating systems.

The renewable resources available to the State's electric utilities vary considerably from island to island. Energy master plans have been drawn up on some islands to further improve energy self-sufficiency. However, the heavy population and tourist concentration on Oahu will make it difficult for significant progress to be made on a state-wide basis until well into the 1990s. Exhibit 8 presents data on energy supply as a percent of the utilities' net electricity sales for each of the counties and illustrates relative energy self-sufficiency for 1990. It should be noted that this does not account for self-generation (e.g., on-site electricity production and use at the sugar plantations). Additionally, in late 1992, 15% of Oahu's electrical demand (19% of energy in 1993) will be supplied from a coal power plant as a result of purchases from an independent power producer.

EXHIBIT 7: Movement of Petroleum to Hawaii 1989/90

(Barrels per Day)



Source: DBED - Energy Division, 1990.

EXHIBIT 8: Energy Self-Sufficiency in the Electric Utility Sector (1990)

Percent of Utility Sales by Fuel Source					
Energy Source	**Oahu**	**Hawaii**	**Maui****	**Kauai**	**State*****
Oil-Based Fuels	**94%**	**76%**	**82%**	**63%**	**90%**
Renewable Energy	**6%**	**24%**	**18%**	**37%**	**10%**
Biomass*	6%	19%	15%	26%	9%
Hydroelectric	–	3%	3%	11%	1%
Wind	<1%	2%	–	–	<1%

* Includes agricultural and municipal wastes
** Includes Maui, Lanai and Molokai
*** State-wide total (rounded to the nearest whole number)

Source: DBED - Energy Division and Department of Commerce and Consumer Affairs Records.

EXHIBIT 9: Comparative Energy Data for the Counties of Hawaii (1990)

Parameter	Oahu	Hawaii	Maui*	Kauai	State**
Transportation Comparisons					
Annual Mileage/Vehicle	8,847	9,765	8,956	10,322	9,071
Fuel Consumption (mpg)***	20.4	18.6	19.8	20.6	20.4
Persons/Vehicle****	1.5	1.2	1.2	1.2	1.4
Electricity Comparisons					
Residential Rate (cents/kWh)	9.2	13.0	11.2	12.2	10.3
Annual Residential Usage (kWh/customer)	7,613	6,581	6,657	5,930	7,272
Gas Utility Comparisons					
Number of Customers	31,947	1,842	382	279	34,450
Total Gas Sold (1000 therms)	31,645	2,297	806	58	34,806
Residential Share of Total	18%	14%	8%	100%	17%

* Includes Maui, Molokai and Lanai
** State-wide total data and weighted average
*** Average miles per gallon
**** Includes all residents, not just licensed drivers

Source: *State of Hawaii Data Book - 1990,* Tables 486, 530, 8 & 518, 512.

In addition to differences in energy self-sufficiency between the counties, considerable variations exist in other aspects of energy. While in some instances differences in energy use patterns can be attributed to differing levels and types of economic activities, there are also land use patterns and infrastructure differences (e.g., road systems). These differences complicate the development of state-wide energy policies. Exhibit 8 presents comparative energy-related data on individual islands. Because of population concentration and corresponding energy demand on Oahu, the energy situation on the neighbor islands is not apparent in the State total.

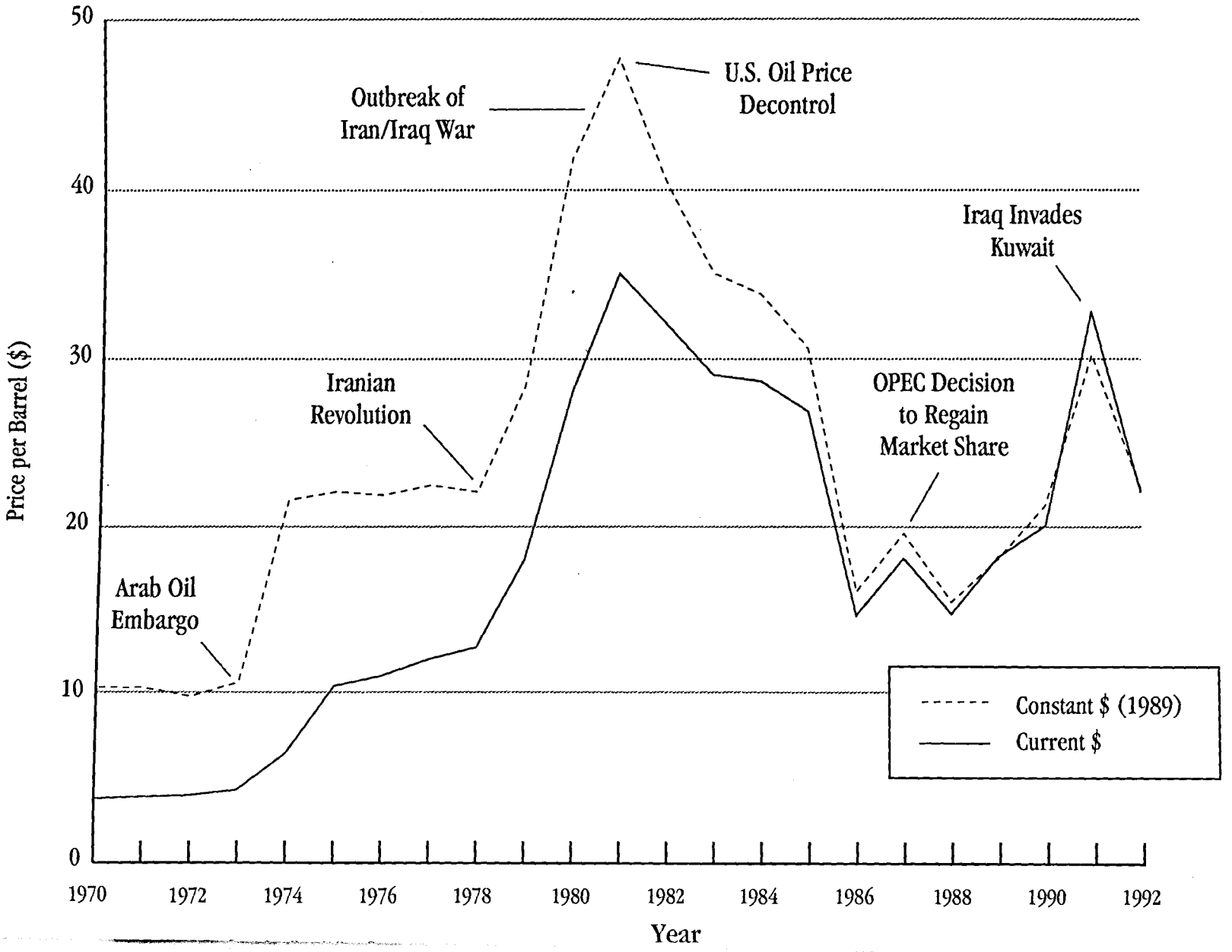
2.4 ENERGY PRICES

With the dominance of imported oil in Hawaii's overall energy consumption, the price of oil is the most important indicator of overall energy prices. That is, the relative cost of oil at the refineries determines the cost of each of the petroleum products. Exhibit 10 indicates the average annual composite cost of crude oil to refineries in the U.S. While the 1990 cost of crude oil is roughly the same in real terms as the cost in 1974, volatile price swings have been experienced as a result of both domestic and foreign events, particularly in the Middle East. It should be noted that the cost of oil reached a high of $66 per barrel in 1981.

Energy prices in Hawaii have traditionally been among the highest in the United States. Although high in comparison with mainland states, energy prices are consistent with other elements in Hawaii's cost of living. In 1989 electricity expenditures for the average residential consumer in the State averaged $663/year and accounted for 1.8% of the market basket used to determine the State's consumer price index. Motor fuel for private vehicles accounted for 2.9% of the market basket used to determine the State's consumer price index.

Overall energy costs declined about 8% between 1985 and 1989, although the Persian Gulf crisis caused major price increases in late 1990. In December 1990, an increase in the federal gasoline tax of 5 cents per gallon went into effect. On July 1, 1991, State taxes on motor fuel were increased by 5 cents per gallon. The electric utilities submitted requests for rate increases on Oahu and the Big Island, which became effective in 1991, and all electric companies are seeking rate increases for 1992.

EXHIBIT 10: Average Annual Cost of Crude Oil *



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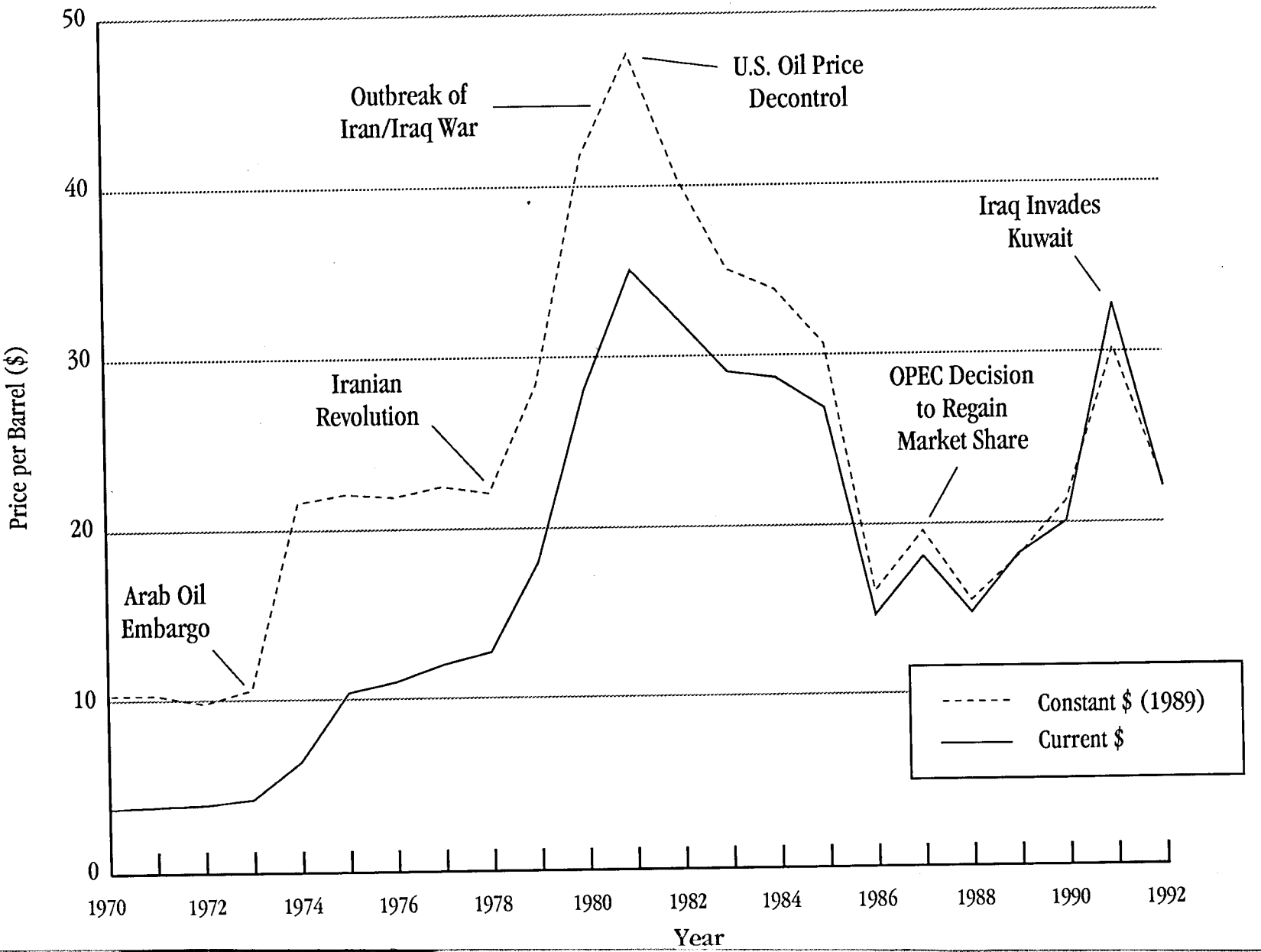

SECTION 3: CROSS-CUTTING ISSUES

Energy production and consumption in Hawaii are interrelated with environmental protection and quality, economic development, and security-related issues. The Hawaii State Plan describes the overall objectives and policies in all of these areas.[14] Recognizing and understanding the interrelationships is important in energy planning, as well as the selection of the specific project size, location and technology used to meet energy service needs.

3.1 ENERGY AND ENVIRONMENT

Hawaii's tropical climate and unique environment have long attracted visitors for study, relaxation and recreation. The State and counties have strict regulations for land, shore and marine-based facilities that are intended to balance the use of natural resources with protection of the quality of Hawaii's fragile environment and unique ecosystem, while enhancing its scenic assets, natural beauty, and historic and cultural integrity. Hawaii's natural resources — trade winds, oceans, volcanism, agriculture and other surface vegetation, rivers and sunshine — make up the State's indigenous energy resource base.

Of primary concern to the State and its residents are the local environmental impacts of energy producing and consuming technologies. These include air emissions (e.g., particulate, lead and other toxic substances, and urban air pollutants such as carbon monoxide and ozone), solid waste, water use and water pollution, land use requirements, and other socio-cultural impacts.

A near-term environmental threat to Hawaii is the fouling of waters and marine habitats from oil spillage, given the current dominance of petroleum in Hawaii's energy mix. Crude oil refining and oil-fired power generation also emit sulfur dioxide (S02) and nitrogen oxides (NOx) and compete for land use.

Coal-fired power generation poses primarily air quality threats through S02 and NOx emissions. The large volumes of water needed to operate steam turbines and warm water discharge in marine and aquatic environments are also concerns. Ash from coal combustion must either be discarded locally or shipped to another location.

Natural gas is considered to be the "cleanest" traditional fossil fuel source, yet its use emits NOx and methane. Land-use requirements are also a problem, particularly if Hawaii were to substantially increase imports of gas in compressed or liquid form.

Fuel cells, using hydrocarbon gases or even water, have virtually no air emissions, water pollution risks, or solid waste products. Fuel cell power plants, however, are land intensive if developed on a centralized basis.[15]

[14] HRS § 226. The Hawaii State Plan is intended to serve as a guide for future long-range development of the State.

[15] The Electric Power Research Institute estimates that a 2-MW molten carbonate fuel cell unit would fit into an area the size of a tennis court.

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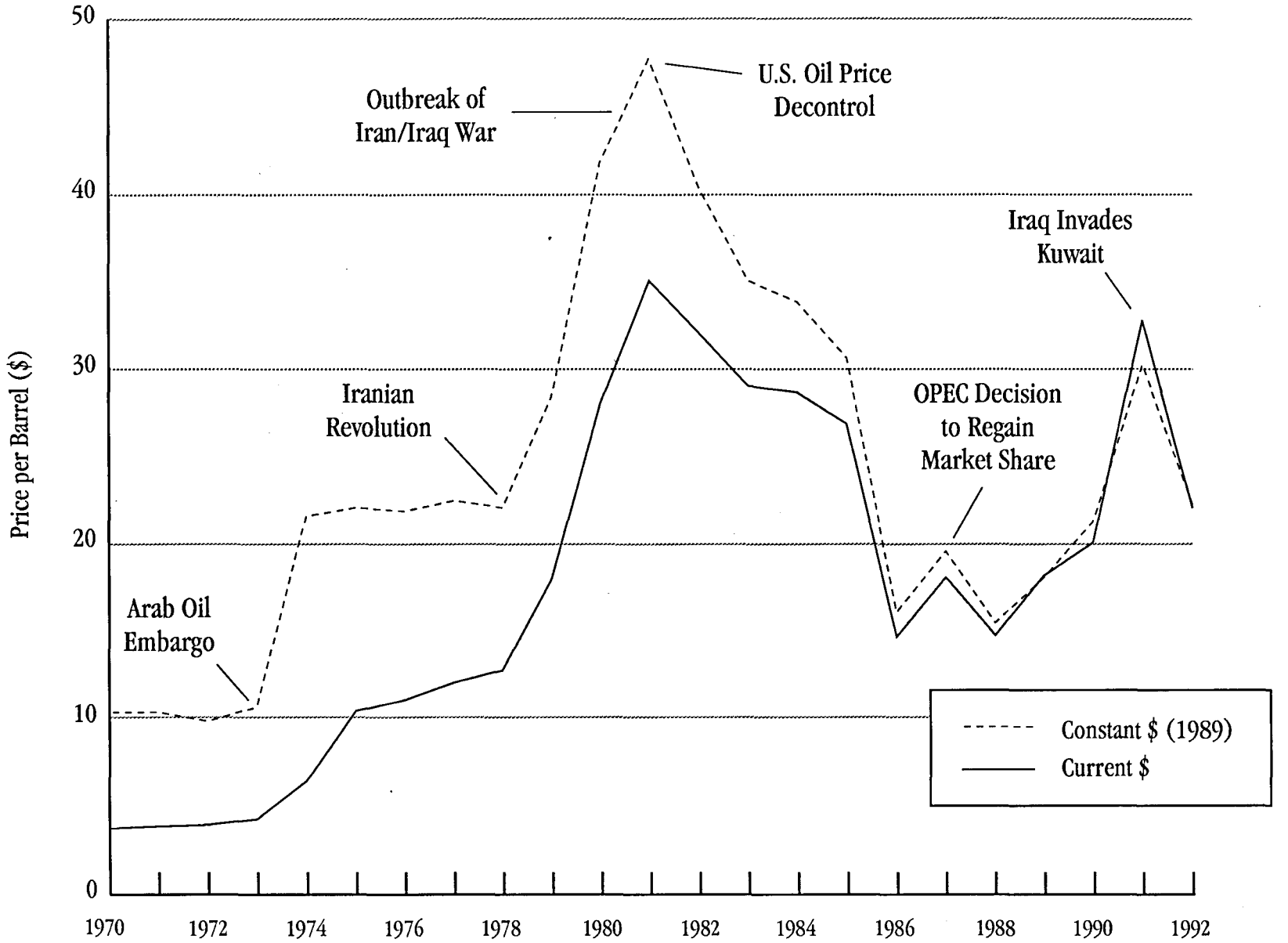

* Composite cost of crude oil to U.S. refiners.

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Geothermal development in Hawaii has drawn social and environmental opposition, primarily due to the proximity of some hydrothermal reservoirs to residential areas and tropical forests of the Big Island. Hydrogen sulfide emissions and underground reservoir depletion are also cited as environmental problems. The cultural significance of Hawaii's geothermal resources potentially poses additional constraints on development.

Wind and solar power systems for bulk electricity generation have large land-use requirements, ranging from 7 to 40 acres/megawatt (MW), and are intermittent in their availability.[16] Ocean thermal energy conversion (OTEC) and wave power systems compete for shoreline access. The major adverse environmental impacts of hydroelectric power development are the loss of traditional land use and wildlife habitat, and disturbances of fisheries habitat. Traditional biomass combustion, such as sugar mill cogeneration, produces some air emissions, requires water for boiler systems, and has comparable land requirements to fossil-fuel plants (excluding the land requirements for growing sugarcane).

End-use technologies, such as solar hot water heaters and energy-efficient appliances, are free from most of the environmental impacts of supply-side options. At the same time, they can save energy and free-up needed generating capacity for utilities. Their higher initial cost and lower operating or monthly fuel costs require changes in consumers' buying behavior, which tends to be toward lowest first-cost. SNG and propane water heating and cooking provide a substitute for electricity; however, combustion releases carbon dioxide, NOx and methane into the atmosphere.

Traditional gasoline-powered vehicles have greatly improved their fuel efficiency through the Corporate Average Fuel Efficiency standards while reducing harmful emissions to meet Federal emissions requirements. Introducing alternative clean burning fuels, such as alcohol, can further reduce air emissions, but may require dedicating large land areas to biomass energy production, unless it is imported. Photovoltaic-powered cars are emission free, but are costly since they are still in a prototype stage. Exhibit 11 indicates the environmental impacts of different electric generation technologies.

In addition to the local impacts of energy resource options, Hawaii must consider its contribution to national and global environmental concerns. In particular, Hawaii's contribution to acid rain and global warming, although not a major concern today, may become an increasing concern in the future.

[16] One-half acre is required for the 20 kW PV system on Maui or 25 acres per megawatt.

EXHIBIT 11: Environmental Impacts of Selected Electric Generating Technologies

Technology-Fuel	Air Pollution	Toxic Waste	Land Use Conflicts	Thermal Pollution of Water
Anaerobic digestion - biomass	○			
Gasification - biomass	○		○	
Combined-cycle power plant - oil	○		○	○
Combustion turbine - oil	○		○	
Steam turbine - oil or biomass	○		○	○
Fuel cell power plant - chemicals		○	○	
Diesel generator	○		○	
Fluidized-bed combustion - coal	○		○	●
Geothermal binary cycle	○		●	
Ocean thermal energy conversion			○	○
Wind power			○	
Small-scale hydropower			●	
Solar thermal electric power plants		○	●	
Photovoltaic power plant			●	
Roof-top photovoltaic system				

○ – minor impact, ● – major impact (see Technical Annex for notes and assumptions).

Source: RCG/Hagler, Bailly, Inc.

3.2 ENERGY AND ECONOMIC DEVELOPMENT

Hawaii's economy has been based on three primary industries: tourism; agriculture; and the military. Since the 1950s, the balance between these industries has changed dramatically. Agricultural income peaked in the 1980s. The defense industry has remained relatively flat since the 1970s. Tourism, which was virtually non-existent in the 1950s, has grown exponentially through 1990 (see Exhibit 12). As is the case in the continental U.S., Hawaii's economic development has and will continue to be dependent on the efficient use and adequate and reliable supply of energy.

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Diesel generator	○		○	
Fluidized-bed combustion - coal	○		○	●
Geothermal binary cycle	○		●	
Ocean thermal energy conversion			○	○
Wind power			○	
Small-scale hydropower			●	
Solar thermal electric power plants		○	●	
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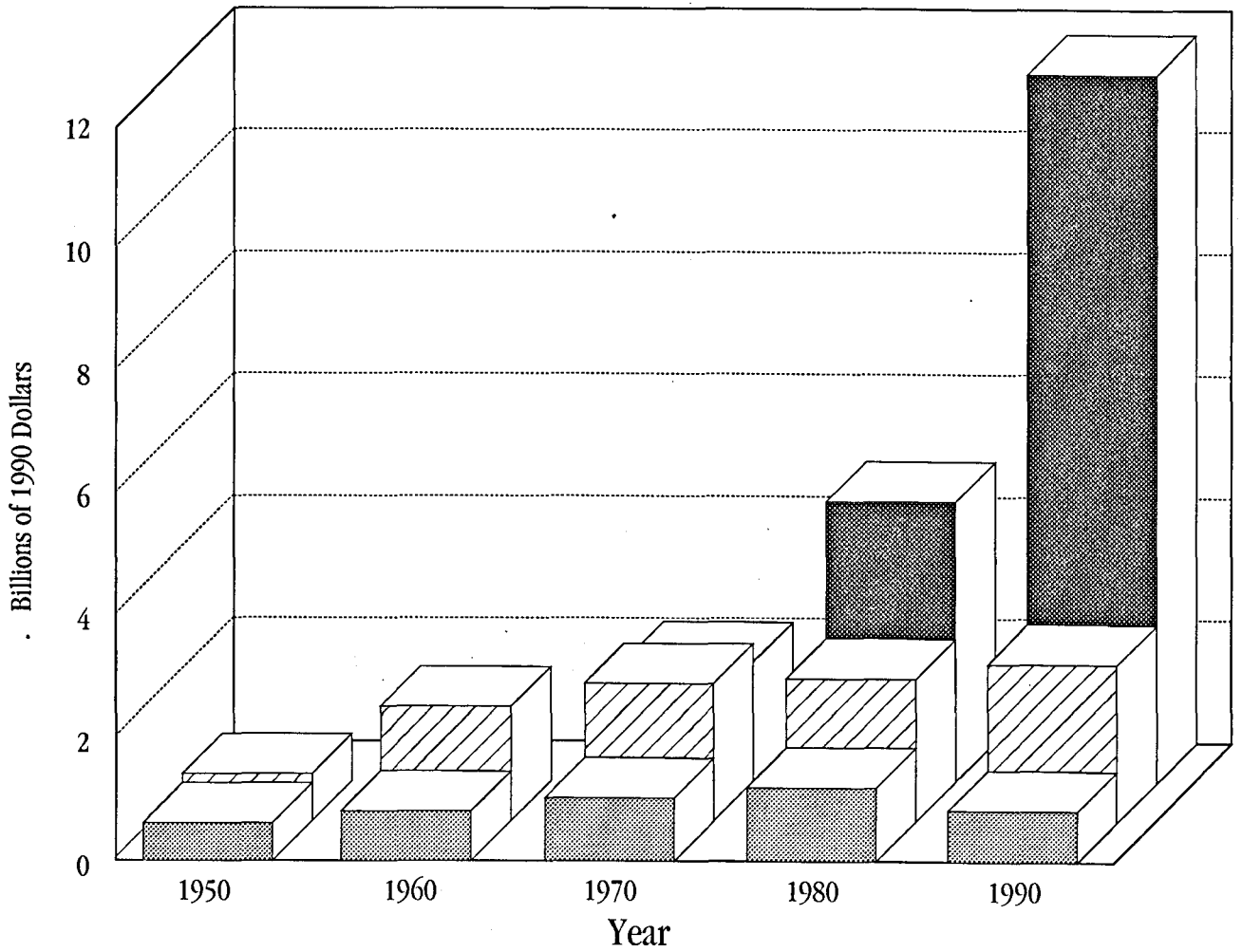
EXHIBIT 12: Growth of Hawaii's Three Primary Industries (1950-1990)



Source: Bank of Hawaii - *1989 Annual Report, 1990.*

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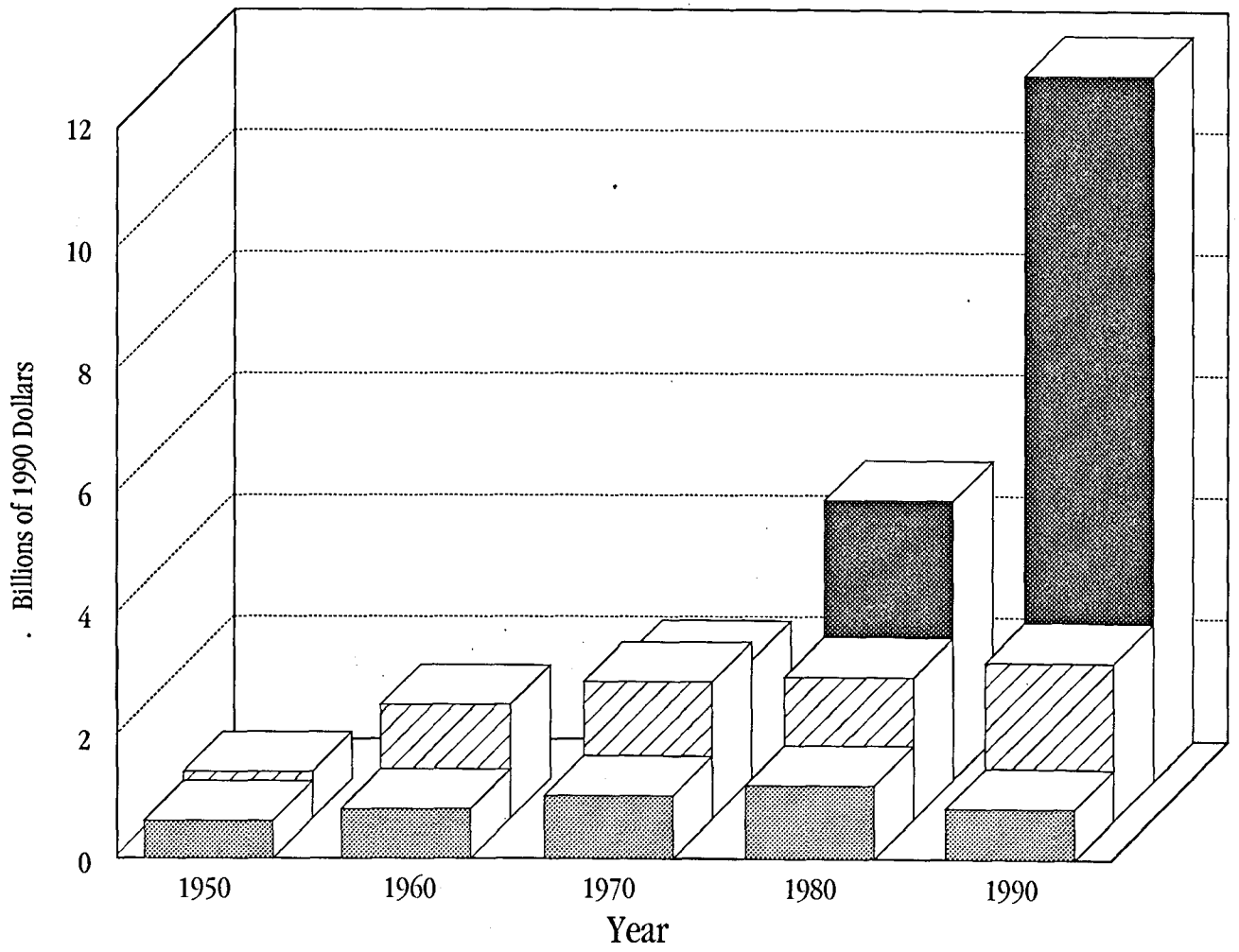


Source: Bank of Hawaii - *1989 Annual Report, 1990.*

The growth and stability of Hawaii's economy are tied to events beyond its shores. This poses unique challenges from an energy planning and management standpoint. The State needs to have ample energy production capability to meet demands during peak tourist seasons, yet tourism and related industries are tied to both the global and national economies. The military presence in Hawaii is determined by both U.S. international relations and the fate of U.S. installations in the Asia/Pacific region. National defense installations, which share the State's civilian petroleum supplies and electrical generating capacity, must be prepared to respond to crises worldwide. The viability of agriculture, and the sugar industry in particular, depends on national farm and trade policies. At the same time, the sugar industry is a significant source of electrical energy, much of which is sold to the utilities for resale.

Over 50% of Hawaii's total land area is dedicated to agriculture and ranching. The State's agriculture objectives are continued viability in Hawaii's sugar and pineapple industries, and the continued growth and development of diversified agriculture throughout the State. Despite growth in other fruits and vegetables (e.g., coffee, macadamia nuts, field crops, and flower and nursery products), sugar and pineapples accounted for 43.4% and 19.7% of total farm income, respectively, in 1989. Energy inputs to agriculture totaled over $40 million in 1987, or 15% of total farm income.

The sugar industry is a vital part of the overall energy supply balance for the State through the on-site burning of sugarcane residues and the operation of small-scale hydropower stations. In 1990, the sugar industry alone accounted for 8.2% of the State's total gross electricity generation, using 499.7 MWh of electricity on-site and selling 302.1 MWh to the local utility for resale to other customers. The contribution of sugar to each island's gross generation varied from 44% on Kauai to less than 2% on Oahu (see Exhibit 13).

EXHIBIT 13: Electricity Production and Use in Hawaii's Sugar Industry (1990)

Island/ County	Generation (MWh)	Purchases (MWh)	Sales (MWh)	Generated by Plantations
Hawaii	234.21	2.83	167.31	27.0%
Kauai	209.19	5.77	111.54	44.3%
Maui*	223.68	0.20	4.81	22.3%
Oahu	110.17	15.76	18.45	1.5%
STATE	777.26	24.56	302.11	8.2%

* Maui county includes Maui, Molokai and Lanai islands.

Source: Hawaiian Sugar Planters' Association, *Energy Report 30,* November 1991.

The energy requirements of the tourist industry can be divided into three areas: jet fuel for airplanes; gasoline and diesel for rental cars and tour buses/vans;[17] and electricity and SNG for hotel and resort use. Jet fuel consumption has stayed relatively flat throughout the 1980s, while motor gasoline consumption has increased by 20% over the same period.[18] In 1983, the last year for which data are available, the number of registered rental cars was 30,000. Between 1980 and 1989, the number of hotels, resorts and other visitor establishments grew from 387 to 453 (and from 54,246 to 68,034 units).[19]

Housing and other real estate development is putting pressure on energy supplies, as well as land use patterns. The number of housing units has grown from 334,235 in 1980 to 402,644 in 1989. Residential electricity usage ranges between 26% and 41% of total sales on the islands. Exhibit 9 showed that there is generally an inverse relationship between the residential electricity rate and average annual usage when comparing the different counties. Oahu has the lowest rate and highest average usage; whereas the other counties have significantly higher rates and lower average usage.

The U.S. Department of Defense owns or controls over 100,000 acres of land for bases, airfields, and other uses, and employs 54,000 persons. The primary energy consumption of the military is in facility use, ground transportation, and jet fuel for aircraft. The military consumed approximately 8% of the state's total liquid fuels in 1988. On Oahu, where the bulk of the military personnel is located, the military sector accounted for over 17% of total electricity sales in 1988.

3.3 ENERGY AND SECURITY

Given the critical importance of energy security to the State's economy and the well being of its citizens, a reliable and economic supply of energy to Hawaii is the keystone of state energy policy. Due to its lack of indigenous fossil fuel resources and its increasing dependence on foreign petroleum imports, Hawaii is becoming more vulnerable to supply disruptions and the attendant volatile price swings. The options for offsetting this vulnerability are limited in the short run and focus mainly on contingency planning for allocating oil supplies and maintaining essential services in an energy emergency.

There are four complementary strategies available to Hawaii to increase its energy security over the longer term:

- Diversification of imported fossil fuel supplies;
- Increased self-sufficiency through use of indigenous renewable resources;
- Improved energy efficiency and energy conservation; and
- Guaranteed access to petroleum stockpiles or reserves.

[17] About 2% of liquified petroleum gas (LPG) sales are used in ground transportation, mainly in tour buses.

[18] *State Energy Data Report - Consumption Estimates 1960-1989,* U.S. Department of Energy, Energy Information Administration, May 1991. Does not include independent imports by commercial airlines.

[19] *State of Hawaii Data Book -1990,* A Statistical Abstract, Department of Business, Economic Development and Tourism, November 1990.

In considering energy security strategies, it is necessary to differentiate the two energy subsectors (i.e., electricity and transportation). It is also important to evaluate specific measures in the context of what the State government can realistically attain.

Complimentary energy security strategies will need to be carefully integrated to maximize their benefit to the people of Hawaii. An example can be seen in electricity generation. In the near-term, the State could encourage the diversification of fossil fuel supplies through the importation of coal for electricity generation with the knowledge that major new renewable energy programs are not likely to begin to significantly affect the State's energy balance until the latter half of the decade. In the transportation sector, indigenous renewable energy sources can be used directly (e.g., biomass fuels) or indirectly (e.g., electrified mass transit).

In many transportation uses, energy conservation strategies will be dictated by technical factors that are largely outside the direct control of the State. For example, reductions in the fuel requirements of road vehicles, ships, and aircraft will be largely determined by national government policies and by the private sector rather than by any policy measure adopted in Hawaii. However, incentives and disincentives can be used together or separately to help shape the demand for gasoline by passenger vehicles.

In addition to energy demand management and emergency preparedness, Hawaii's energy security strategy must stress a carefully thought out emergency preparedness plan supported by a local petroleum reserve and possibly a biomass reserve to weather unexpected fuel supply disruptions. Another strategy that the State could pursue as an energy security measure for the 1990s can be the promotion of fuel switching capability in power plants and, eventually, in private passenger vehicles.

SECTION 4: A RECOMMENDED INTEGRATED ENERGY POLICY FOR HAWAII

The HEP Program represents the first attempt by the State of Hawaii and its constituent energy community to produce a comprehensive State Energy Policy designed to facilitate the accomplishment of Hawaii's energy objectives. The specific recommended policy initiatives are summarized in Section 1 of this report, and are listed at the end of each of the following sections:

4.2 Overall State Energy Policy and Planning
4.3 Integrated Utility Resource Planning
4.4 Enhancing Energy Efficiency and Renewable Energy Development
4.5 Transportation Energy Use
4.6 Energy Emergency Preparedness

4.1 THE HEP PROGRAM

The two-year HEP Program began with an organizational structure of task forces, each with specific objectives and the participation of relevant stakeholders. The task forces or work groups and their respective objectives are described below. Exhibit 14 illustrates the HEP process.

Integrated Resource Planning (IRP) - On September 14, 1990, the PUC issued Order No. 10458, which called for "the development of an integrated resource plan applicable to the energy utilities of Hawaii." The formal PUC proceeding will lead to the development and adoption of guidelines to be used by each of the regulated energy utilities in their preparation and implementation of integrated resource plans. Although the IRP proceedings are independent of the HEP process, many participants are part of both efforts.

Inter-Agency Role Clarification (IRC) - The IRC Task Force was responsible for assessing the goals and roles of the State's public and semi-public agencies and private organizations as they relate to the achievement of Hawaii's energy objectives. In their review and analysis, the IRC Task Force made specific institutional recommendations on organizational responsibilities and structures, as well as inter-organizational relationships.

Enhancing Renewable Energy Development in Hawaii (EREDH) - The EREDH Task Force was given the responsibility of identifying impediments to the commercial development of renewable energy and energy efficiency in Hawaii, and to make specific recommendations to address those impediments. The EREDH Task Force was also given the lead responsibility on transportation sector energy issues.

Energy Emergency Preparedness (EEP) - The Governor's EEP Committee and the Issues Subcommittee reviewed existing EEP policies, plans and procedures. The EEP function includes the preparation of a comprehensive plan to deal with a wide variety of disruption scenarios and the development of formal administrative rules to govern the procurement, control, distribution and sale of petroleum products during a fuel shortage.

The proposed policy initiatives emerging from the task forces were reviewed, screened and analyzed by the IG, which had the primary responsibility for drafting the HEP. The IG and its consultants presented the draft policy document to the EPAC and the counties. The HEP report was reviewed at a series of public review meetings, held on Hawaii (Hilo and Kona), Kauai, Lanai, Maui, Molokai and Oahu. The ERC (Chairman of the EPAC) transmitted the HEP report and recommended policy initiatives to the Governor prior to the 1992 legislative session.

The membership of each of the task forces and work groups is included in the appendices.

Policy Development and Evaluation Process

From the outset, the participants in the HEP realized that the traditional way energy policies are developed, evaluated and implemented in Hawaii was insufficient. Moreover, the State's ad-hoc approach made it difficult to compare the merits of one proposal against another. In order to present a truly "integrated" energy policy and ensure that only those policies with the broadest base of support and with benefits that outweigh costs are pursued, a new, more systematic process was necessary.

The HEP process calls for policy making to be viewed as a process, rather than a discrete decision. The critical steps in policy decision making must include: clarifying a problem, issue or need; identifying policy options; adopting a policy; implementing it; evaluating its effectiveness (both process and results); and, if needed, modifying a policy or its implementation to address ineffectiveness. In this regard, evaluation is viewed as part of an information-producing system that feeds into a cyclical policy-making process.

Policy Initiative Time Frame

The HEP Program is designed to present policy recommendations for meeting the State's energy objectives. Because the individual initiatives vary in cost and level of complexity, the HEP Program assigns a time frame to each initiative. The time frame options are:

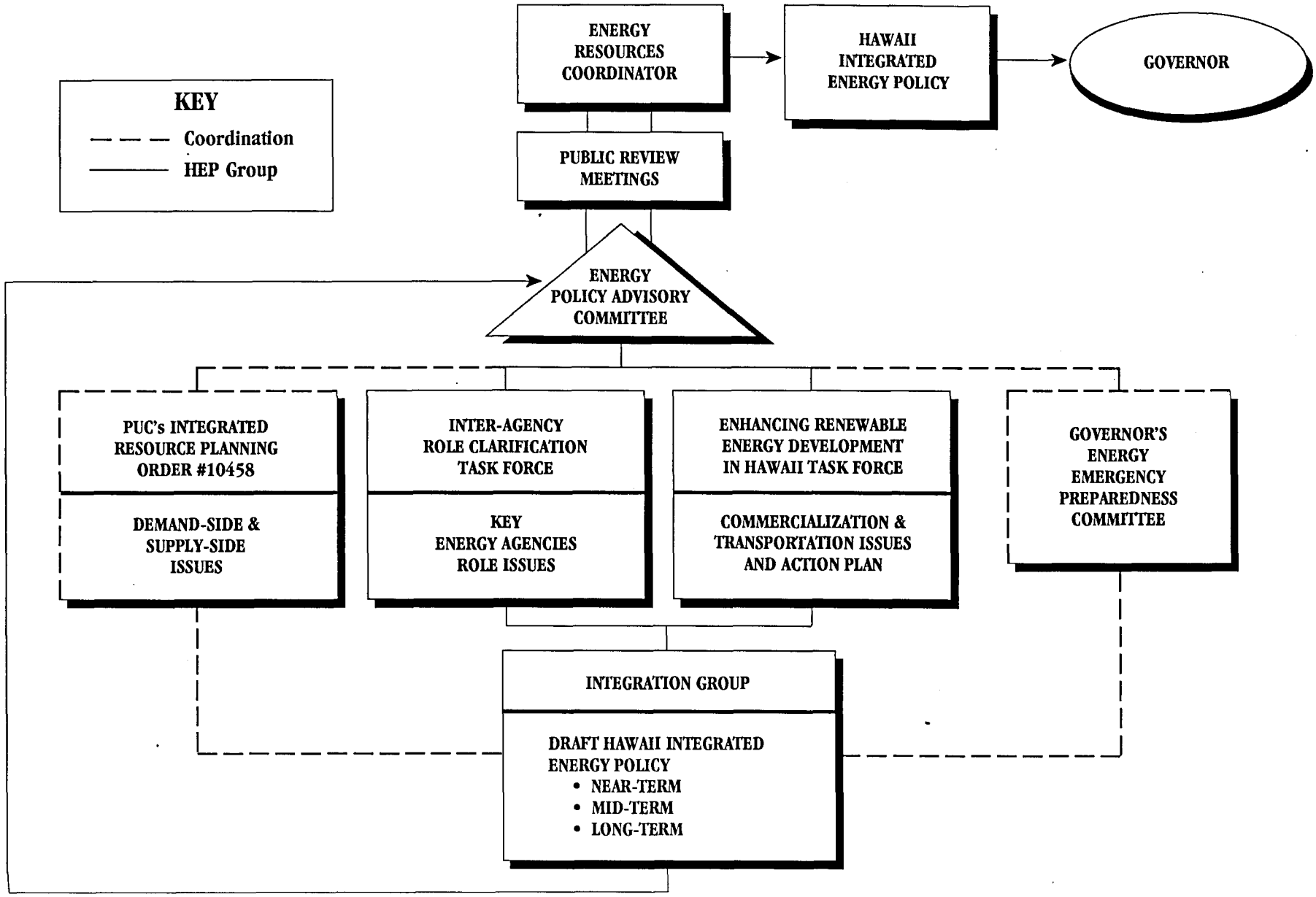
- Near-term recommendations – These recommendations can be implemented in the near future, i.e., less than one year;
- Mid-term recommendations - This category of recommendations may require new legislation, regulatory changes, and/or greater reallocations of staff and other resources to implement. Accordingly, their implementation time frame is longer (i.e., 12 to 24 months); and
- Long-term recommendations - The final category of recommendations will call for yet more significant changes and will require several years to implement. This category of recommendations will represent a long-term vision for Hawaii's energy future.

4.2 OVERALL STATE ENERGY POLICY AND PLANNING

Historically, energy policy development and implementation have been the responsibility of the ERC. Chapter 196 of the HRS designates the Director of DBED as the ERC. Among the powers and duties assigned to the ERC are:

- Formulate plans for the optimum development of Hawaii's energy resources;
- Conduct systematic analyses and recommend to the Governor and Legislature programs that represent the most effective allocation of resources for the development of energy resources;
- Formulate and recommend specific proposals for conserving energy and fuel, including allocation and distribution, to the Governor and Legislature;

EXHIBIT 14: HAWAII INTEGRATED ENERGY POLICY (HEP) DEVELOPMENT PROCESS



- Coordinate the State energy conservation and allocation programs with those of the Federal Government, other state and foreign governments;
- Develop programs to encourage private and public exploration and research of alternative energy resources that will benefit the State;
- Serve as an advisor to the Governor, public agencies and private industry on matters related to the acquisition, utilization and conservation of energy resources; and
- Review proposed State actions that the coordinator finds to have significant effect on energy consumption and report to the Governor and/or Legislature their effect on the energy conservation program.

Hawaii Energy Objectives and Policies

One of the first topics addressed in the HEP Program was the overall energy objectives and policies contained in the Hawaii State Plan. After a review and discussion, the HEP participants proposed the following changes to Section 226-18 of the State Plan:*

"Objectives and policies for facility systems — energy. (a) Planning for the State's facility systems with regard to energy shall be directed toward the achievement of the following objectives:

(1) Ensure a [Dependable] dependable, efficient, and economical energy... system capable of supporting Hawaii's needs.

(2) [Increased] Increase energy self-sufficiency.

(3) Ensure energy security.

(b) To achieve the energy...objectives, it shall be the policy of this State to ensure the provision of adequate, reasonably priced and dependable [power] energy services to accommodate demand.

(c) To further achieve the energy objectives, it shall be the policy of this State to:

(1) Support research and development as well as promote the use of renewable energy sources.

(2) Ensure a sufficient supply of energy to enable power and transportation systems to support the demands of growth.

(3) Promote prudent use of power and fuel supplies through conservation measures including:

(A) Development of cost-effective demand-side management programs;

(B) Education; and

(C) Adoption of energy efficient practices and technologies; and

* [] denotes deletions and __ denotes proposed additions to the Hawaii State Plan, Chapter 226-18, Objectives and Policies for Facility Systems-Energy/Telecommunications.

(4) Ensure that the development of [power] energy systems and sources adequately consider environmental, public health[,] and safety concerns, other social impacts, and resource limitations.

(5) Promote alternate fuels and energy efficiency by encouraging diversification of transportation modes and infrastructure."

The revised energy objectives and policies served as a screening tool in reviewing policy initiatives proposed by the HEP task forces. In evaluating policy initiatives, each of the energy objectives was further defined as indicated below. Initiatives that addressed one or more objectives and were consistent with one or more policies were retained for further analysis. Those that were not were eliminated.

Energy Objective Definitions

"Ensure a dependable, efficient and economical energy system capable of supporting Hawaii's needs" is further defined as:

- To ensure a sufficient and reliable energy production and distribution system (infrastructure) to meet normal demand and emergencies;
- To ensure an adequate and reliable energy supply to meet demand, plus reserves/contingencies to meet changes in supply and demand;
- To ensure efficient production, distribution and end-use of energy (e.g., percent losses in each stage, penetration of efficient technologies, process and systems, efficiency index related to other jurisdictions, energy intensity by sectoral index);
- To ensure least-cost means of meeting energy service needs; and
- To ensure pricing systems that efficiently allocate resources and internalize measurable external costs.

"Increase energy self-sufficiency" is further defined as: to increase the ratio of indigenous to imported energy.

"Ensure energy security" is further defined as:

- To expand the portfolio of available energy options;
- To increase assurance(s) of the delivery of existing sources of supply, including stockpiling;
- To increase the number of possible sources of supply of a given resource;
- To shift toward more secure or stable sources of supply of a given resource; and
- To reduce potential adverse impacts of threats to energy supply.

Hawaii's "Energy Community"

Hawaii's energy future depends, in large part, on the various components of the "energy community." The current institutional structure is largely an outgrowth of the development of the islands, with traditional industries like sugar being energy self-sufficient in electricity supply, private oil refining companies feeding the State's appetite for petroleum products, regulated gas and electric utilities providing public service needs, research institutions and private companies experimenting with new and innovative energy options, and a number of environmental and public interest groups working to shape development of the State's energy resources. Exhibit 15 and Exhibit 16 indicate the areas of involvement by specific state and county government agencies, respectively.

The HEP process revealed insufficient State and county capabilities and efforts in overall energy policy and planning. Although several agencies have functional responsibility for these activities, their inadequate staffing and resources, as well as lack of coordination, make it difficult to provide the necessary leadership in managing Hawaii's energy situation. The work of the HEP has shown:

- There are essential energy policy and planning functions that are not being adequately fulfilled;
- There is a need to improve the efficiency of State permitting and approvals required for the siting and development of energy facilities;
- A mechanism is required to ensure that duplication of effort is avoided, that major energy stakeholders are involved in the development of State energy policy, and that the State's energy agency serves as an advocate and facilitator; and
- Energy needs to be given a much higher priority by the State and County governments, and the general public.

The essential energy policy and planning functions not being adequately fulfilled include energy forecasting, integrated energy planning, energy policy development, and technology assessment. Without the additional capability in State government (in cooperation with the counties and the private sector) to perform these functions, rational energy planning and development cannot take place. Moreover, Hawaii cannot hope to meet its energy goals without more effective energy planning, policy development and implementation, including pricing.

The existing systems of permits and approvals required for the development and siting of energy facilities have seriously impeded the development of alternative energy in the State. As noted in the IRC Task Force report, energy development activities can require up to 20 federal, 46 state, and 38 county government permits and approvals. If the State hopes to achieve its energy goals, there is a critical need to improve the efficiency of the existing systems to comply with all the requirements of the federal, State, and County governments.

The State's slow progress in meeting its energy objectives can be attributed, in part, to the absence of an integrated energy policy. This, combined with the relatively low cost of oil experienced since the State first established its current energy policies, has made it difficult to achieve its increased energy self-sufficiency objective. The HEP process has demonstrated that only through the active participation of federal, state,

EXHIBIT 15: Functional Responsibilities of State Government Agencies

Institution	Energy Emergency Preparedness	Information Handling	Demand/ Supply Forecasting	Policy Development	Energy Planning	Utility Regulation	Coordination	Resource/ Technology Assessment	Technology Development	Permitting	Technical Assistance	Public Education
STATE												
Department of Business, Economic Development and Tourism	●	●	○	●	○		●	○	●	○	●	●
Public Utilities Commission		●	●	○	○	●	○	○		●		
Department of Transportation	○	○		○			●			●	●	○
Department of Commerce and Consumer Affairs	●	●	○	○	○	○		○		○	○	○
Department of Health										●		
Department of Land and Natural Resources				○				○		●		●
Civil Defense	●						●					
Land Use Commission										●		
Office of State Planning			○	○			●			●		
Office of Environmental Quality Control										●		
Hawaii Community Development Administration										●	○	
Department of Education												○
Department of Labor and Industrial Relations										●		

Key: ● = Lead Responsibility; ○ = Support Responsibility; = No Responsibility

EXHIBIT 16: Functional Responsibilities of County Government Agencies

Institution	Energy Emergency Preparedness	Information Handling	Demand/ Supply Forecasting	Policy Development	Energy Planning	Utility Regulation	Coordination	Resource/ Technology Assessment	Technology Development	Permitting	Technical Assistance	Public Education
CITY AND COUNTY OF HONOLULU												
Mayor's Office	●			○	○		●			○		
City Council				○	○					○		
Building Department										●		
Civil Defense Agency	●											
Department of General Planning	●				○					●		○
County Planning Commission										●		
Department of Land Utilization										●		
Department of Public Works										●		
Department of Transportation Services					○							○
Department of Housing and Community Development											○	○
County Coordinating Agency							●			●		
Fire Department										●		
Board of Water Supply						○				●		

Key: ● = Lead Responsibility; ○ = Support Responsibility; = No Responsibility

EXHIBIT 16: Functional Responsibilities of County Government Agencies (cont'd)

Institution	Energy Emergency Preparedness	Information Handling	Demand/ Supply Forecasting	Policy Development	Energy Planning	Utility Regulation	Coordination	Resource/ Technology Assessment	Technology Development	Permitting	Technical Assistance	Public Education
COUNTY OF HAWAII												
Mayor's Office	●			●	○		●			○		
County Council				○	○					○		
Planning Department										●		
Department of Public Works										●		
Department of Research and Development	●	○		○	○		●	○	●	○	●	●
Civil Defense	●											
Fire Department										●		
County Coodinating Agency							●			●		
Department of Water Supply										●		
COUNTY OF KAUAI												
Mayor's Office	●			●	○		●			○		
County Council				○	○					○		
Planning Department										●		
Department of Public Works										●		
Department of Economic Development	●	●		○	○		●			○	●	●
Civil Defense	●											
Fire Department										●		

Key: ● = Lead Responsibility; ○ = Support Responsibility; = No Responsibility

EXHIBIT 16: Functional Responsibilities of County Government Agencies (cont'd)

Institution	Energy Emergency Preparedness	Information Handling	Demand/ Supply Forecasting	Policy Development	Energy Planning	Utility Regulation	Coordination	Resource/ Technology Assessment	Technology Development	Permitting	Technical Assistance	Public Education
County Coordinating Agency							●			●		
Department of Water Supply										●		
County Planning Commission										●		
COUNTY OF MAUI												
Mayor's Office	●			●	○		●			○		
County Council				○	○					○		
Planning Department	●	○		○	○		●	○		●	○	●
Department of Public Works										●		
Civil Defense	●											
County Coordinating Agency							●			●		
Department of Water Supply										●		
County Planning Commission										●		
Fire Department										●		

Key: ● = Lead Responsibility; ○ = Support Responsibility; = No Responsibility

Energy Emergency Preparedness - preparation of energy emergency management plans; **Information Handling** - involved in information/data collection and analysis; **Demand/Supply Forecasting** - preparation and analysis of long range energy forecasts; **Policy Development** - involved in developing and analyzing energy policies; **Energy Planning** - conducts comprehensive energy planning; **Utility Regulation** - involved in the regulation of energy utilities; **Coordination** - coordinates government energy functions and activities; **Resource/Technology Assessment** - conducts assessments of energy resources and technologies; **Technology Development** - involved in the research, development and commercialization of energy technologies; **Permitting** - responsible for reviewing and/or permitting energy facilities; **Technical Assistance** - provides technical assistance on energy matters; **Public Education** - involved in education and information dissemination of energy material.

and county officials, public utilities, other private energy firms, non-profit organizations and environmental groups can an effective integrated energy policy be developed. Moreover, experience with the HEP process has made it clear that there is a critical need to involve the entire energy community in energy policy development and planning on an on-going basis. Therefore, if the State is to achieve its energy goals, the HEP process must be institutionalized.

As the analysis of Hawaii's energy situation in other parts of this report indicates, the State has not become any less dependent on imported energy since 1974. Given the importance of stable energy costs, environmental protection, and security to the State and its economy, the achievement of greater energy self-sufficiency must be given much higher priority than it has in the past.

EXHIBIT 17: Permits and Approvals That May Be Required for an Energy Project

	Environmental Review	Environmental Impact	Construction/ Operation	Land Use/ Zoning	Utility	TOTAL
Federal	1	13	3	1	1	20
State	2	12	10	16	4	46
County	1	2	10	24	1	38
TOTAL	4	27	20	41	6	104

Source: RCG/Hagler, Bailly, Inc.

Organizational Options

Participants in the HEP process felt that some of the state's problem may result from institutional deficiencies and that a possible reorganization or strengthening of state government energy-related functions might improve the state's ability to plan and manage its energy production and use. In order to determine whether institutional changes were necessary and what changes should be made, an institutional analysis was conducted. Six possible institutional options were considered:

1) Enhancement of the status quo;
2) Creation of an energy division within the Public Utilities Commission;
3) Creation of a sub-cabinet level Hawaii Energy Agency;
4) Creation of a cabinet level Department of Energy;
5) Creation of a Department of Energy and Environment; and
6) Creation of a Hawaii Energy Commission attached to the Department of Land and Natural Resources (DLNR).

In a preliminary review of the options, several criteria were used to identify the most appropriate and likely institutional change for the State. The criteria included:

- The degree to which the organizational option would result in energy being given a much higher priority by State and County governments and the general public;
- The degree to which the organizational option would result in the adequate fulfillment of essential policy and planning functions;
- The degree to which the organizational option would facilitate permitting and approvals for the siting and development of energy facilities;
- The degree to which the organizational option would result in a reduction of duplication of effort in alternative energy development;
- The degree to which major energy stakeholders would be involved in the development of State energy policy;
- The degree to which the State's energy agency can serve as an advocate and facilitator for effective energy management in support of State energy objectives; and
- The financial and political feasibility of a particular option.

Option 1: Enhanced Status Quo

This option would entail: 1) the expansion of the DBED - Energy Division to meet the functional needs not currently being fulfilled, particularly energy planning and policy development; and 2) the addition of staff to analyze and recommend ways to streamline the permits and approvals process. This option would probably have little impact on the public perception of the importance accorded to energy issues by State government. It would, however, ensure that essential policy and planning functions are adequately fulfilled. It seems unlikely that the Energy Division would have sufficient influence with State government regarding the permits and approvals process to result in any significant improvement in its efficiency although it could serve as an advocate and facilitator. The dual role of facilitating permits and acting as an advocate for energy project development may also pose a conflict of interest. An enhanced status quo would address a numher of the problems identified in the HEP process but would leave the state without the focus and sense of purpose and authority a Department of Energy would create.

A policy advisory body, with sufficient outside representation, could be incorporated into the existing organizational structure, whereby stakeholders could have a role in energy policy development. Of the six options considered, enhancing the status quo would be the least expensive and the least administratively disruptive, and it would probably be the most politically acceptable. However, without raising the State's energy management responsibility above the division level, the Energy Division would have recurring difficulties in securing the necessary resources to adequately "enhance" their current capabilities.

Option 2: Establishment of an Energy Division within the Public Utilities Commission

This option would entail moving the Energy Division from within DBED to the PUC to serve as staff and technical resources to the PUC in its regulation of energy utilities. This option would probably do little to give energy a higher priority among State and County governments. As part of the PUC, the energy unit could be viewed as being outside the departmental structure and would have no voice in the State administration. If adequately staffed, essential energy policy and planning functions could be fulfilled under this option, although policy might be constrained by the commission's more narrow scope of responsibility, i.e., utility regulation. A conflict may occur, for example, if staff recommendations suggest a higher-priced option for the ratepayer as a means of meeting State policy objectives (e.g., increase energy self-sufficiency). On the other hand, experience in some other states, e.g., Minnesota, suggests that placing a state energy division, with its strong experience in energy efficiency and renewable energy, within a PUC can significantly strengthen the PUC's ability to direct and implement efficiency and renewable energy programs through the regulated utilities. The short-coming of this alternative is that the state tends to lose its capability for comprehensive energy planning and focuses only on utilities. This could be a step backward for Hawaii, with its heavy dependence on imported oil and the importance of the transport sector in the state's energy use.

It is uncertain how a separate policy advisory body would relate to the appointed commissioners, in terms of giving stakeholders a voice in state energy policy. The cost of this option could potentially be the same as the "enhanced status quo" option, but it would be administratively more disruptive if staff had to be transferred from DBED to the PUC.

Option 3: Creation of a Hawaii Energy Commission attached to the DLNR

The creation of a Hawaii Energy Commission would possibly result in a higher profile for energy issues than would be achieved in options 1 and 2. Like the other options, essential policy and planning needs could be fulfilled with adequate staffing. If State permits and approvals for energy projects were consolidated under the Commission, some efficiency improvements would also occur. However, as witnessed elsewhere in the country, namely California, an energy commission can add a new bureaucracy and new regulatory and/or approval requirements to the existing departmental structure of state government, and, unless given sweeping powers, may result in added duplication of effort and regulation. Stakeholders could be represented on the Commission, but unless the number of commissioners were limited, the Commission (as a decision-making body) could become ineffective. Commissions, as a rule, are formed to insulate decision-making from political influence and are usually required where significant regulatory decisions are made. However, the Energy Division has no regulatory authority to warrant the commission structure, and such a structure would most likely decrease the accountability and responsiveness of the energy function within Hawaii state government more than the status quo. It should also be noted that individuals appointed to commissions, as a rule, must resign from their current professional affiliation in order to avoid perceived conflict of interest. The cost of a commission would be higher than either option 1 or 2, and the establishment of another commission for the State government would probably bring considerable resistance, especially if it were given extensive regulatory powers.

Option 4: Creation of a Cabinet Level Department of Energy

The creation of a cabinet level Department of Energy would give energy a higher priority within State government than any of the options discussed. As an executive-level department, it would provide greater influence over State energy policy and the policies and operations of other State agencies. The director, as a cabinet member, would have direct access to the Governor. As with the other options, adequate staffing would ensure that essential policy and planning functions are fulfilled. The Department would probably be more successful in attempts to facilitate the permitting and approvals process and could serve as an effective advocate for efforts aimed at achieving State energy goals. Through an advisory body, energy stakeholders could have a voice in the development of State energy policy. This option would be more costly than an "enhanced status quo" or the relocation of the Energy Division within the PUC. Given the limited number of departments authorized by the State Constitution, however, it may be politically difficult to create a new department.[20] Nonetheless, the Department of Energy option represents the most effective institutional model for Hawaii.

Option 5: Creation of a Department of Energy and Environment

This option would combine option 4, above, with current efforts to create a Department of Environment. The rationale for the creation of such a department would be that many environmental problems are energy related and thus could presumably be analyzed and resolved more efficiently in a single department. This combination also gives both functions a cabinet level, departmental status without violating the constitution. Merging environmental protection functions, however, with energy planning and development functions in the same agency could undermine the opportunity for public involvement and critical outside review when energy-related environmental issues surface. Energy development and environmental protection are often in conflict and such conflicts should be resolved in a transparent and public process. It is much more possible for such conflicts to be resolved internally, without such a public process, if these two functions are merged under a single executive head. Thus, it would seem that the harm which could result from the loss of normal checks and balances in this option far outweigh any gains made from administrative efficiency.

Option 6: Creation of a Sub-Cabinet Level Hawaii Energy Agency

This option would involve establishing an free standing agency which would not have cabinet status. The agency head would be appointed by, and report directly to, the Governor, but the agency would be attached to a department for administrative purposes only (possibly DBED). This option has most of the benefits of a Department of Energy in terms of increased visibility, and clear lines of communication and authority, but avoids the constitutional problem of creating another cabinet-level agency. It is also less expensive than the creation of a new department with its own separate administrative staff.

Unlike the Department of Energy and Environment, this option allows the director to focus on energy issues exclusively. It would result in energy issues being given a higher priority within the State administration. The director of the agency would have greater access to the Governor than in options 1-3. Essential policy

[20] A Department of the Environment will be considered during the next legislative session. If passed, that would only leave one vacant department slot.

and planning functions could be fulfilled if the agency were adequately funded and staffed. Stakeholders could have a voice in energy policy and planning through an advisory body attached to the agency. Financially, this option would be less expensive than an Energy Commission, Department of Energy or combined energy and environment department. It would also be somewhat more politically palatable, due to its lower cost and slightly lower profile than a cabinet level department. Preliminary discussions with the Attorney General's office indicate, however, that a sub-cabinet level agency is not an option under Hawaii's Constitution. Thus, this option does not appear to be legally feasible.

Institutional Findings

From the analysis which has been done on the institutional issue, it emerges that adequate staffing, funding and relevant statutory authority are more important to effective state energy management than the specific organizational option chosen. Although reorganizing state government to create an autonomous Department of Energy will provide a more robust and flexible structure with which to deal with the ever-changing energy situation, it will not be sufficient by itself to substantially improve the state's energy management capability. Assuming, however, that adequate staffing and authority are provided, the creation of a Department of Energy is perhaps the best option for the state at this time. It provides the visibility, stature and clear line to the Governor required to give energy management a stronger decision-making base within the state, while providing a focal point for the public to present its opinions. With only two openings remaining under the constitutional limit of twenty state departments, however, and a Department of Environment currently under consideration, the creation of a Department of Energy would involve using the slot available under the constitution. The creation of any other departments would then require a constitutional amendment or the consolidation of some existing departments.

Policy Advisory Committee

Participants in the HEP process believe, as already indicated, that a Policy Advisory Committee should also be established. The purpose of the Committee is to provide a structure for on-going integrated energy planning and policy development and the coordination of energy development activities in the State. The Committee would serve in an advisory capacity to the Director of the Department of Energy. The Committee would be composed of representatives from the educational and research institutions involved in alternate energy development, the major energy suppliers and producers, appropriate Federal and State agencies, County governments, private energy developers, environmental groups, and the public at-large. The public strongly supported the creation of a new energy agency.

Institutional Change – A Difficult Decision

The recommendation regarding the creation of a Hawaii Department of Energy was the product of the consultants' in-depth institutional analysis that used the input from the HEP's IRC Task Force, previous HEP report drafts, a functional analysis of the State's energy management activities, and a comparative analysis of other states' energy management institutional arrangements. It does <u>not</u>, however, reflect a consensus of the EPAC.

However, during its final meeting on November 15, 1991, the EPAC did acknowledge Hawaii's institutional issues related to energy management. The EPAC also supported the need for improved energy management functions – including comprehensive energy planning; increased Administrative emphasis, commitment and visibility to the energy program; and the need for a stable resource base for Energy Division staff and program activities. So, although there was clear agreement concerning the institutional issues, the EPAC could not agree on the optimal institutional structure to resolve them. Therefore, the final selection is left for the ERC's consideration.

Recommendations

The overall state energy policy and planning recommendations are:

- **Hawaii should create a Department of Energy, with the intent of increasing the stature of, and administrative emphasis on, energy activities.** The new agency should have primary responsibility for conducting energy planning and policy development, establishing priorities and overseeing energy research and development programs, and working toward improving the efficiency of and facilitating the permitting and approvals process without compromising environmental and other standards. This is a near- to mid-term recommendation.

- **Hawaii should prepare and publish a biennial Hawaii Energy Plan to replace the Energy Functional Plan.** The Hawaii Energy Plan should contain specific policy recommendations and budget requests. It should integrate the findings of the Energy Emergency Preparedness Plan, the Long Range Energy Supply/Demand Forecasts, the Energy Technology/Resource Assessment Report, the Comprehensive Research, Development and Commercialization Strategy, and the Energy Conservation Plan. An Energy Policy Advisory Committee should review and provide input to the Hawaii Energy Plan. The public should also have ample opportunity to provide their input through formal and informal processes. This is a near- to mid-term recommendation.

- **Hawaii should amend the Hawaii State Plan, HRS Section 226-18, to include an additional objective to "ensure energy security" and an additional policy to "promote alternative fuels and energy efficiency by encouraging the diversification of transportation options and infrastructure."** In addition, all references to power should be broadened to include all energy systems. These changes more closely reflect the structure of the HEP Program and the energy use patterns of the State. This is a near-term recommendation.

- **Hawaii should establish an Energy Program Support Fund.** Energy consumption surcharges or fees would be assessed to provide sufficient funds to off-set declining federal PVE monies. A stable funding source is necessary to support the critical State energy management functions, many of which are currently not being done. This is a mid-term recommendation.

- **Hawaii should conduct an analysis of impacts of oil supply disruptions and/or sharp increases in oil prices on the local economy.** The intent is to develop a model and build the capability within the State's economic planning function to account for the dependence on imported oil. This is a mid-term recommendation.

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- **Hawaii should establish a range of institutional mechanisms to aid the resolution of disputes among energy stakeholders.** The intent is to make energy project development a more proactive process where stakeholders can resolve contentious issues early in the planning process and gain public support outside formal or legal processes. This is a near- to mid-term recommendation.

- **Hawaii should prepare and publish an energy technology/resource assessment report which analyzes the internal/external costs and benefits of different energy options appropriate for Hawaii.** The analysis, which should be updated regularly, can be used for specific planning and evaluation purposes (e.g., assigning external costs or credits in integrated utility resource planning), as well as general education activities. The report should feed into the Hawaii Energy Plan. This is a near- to mid-term recommendation.

4.3 INTEGRATED UTILITY RESOURCE PLANNING

Electric and gas utilities have performed resource planning of various types for many years. Recently, however, and often at the urging of state public utility commissions, U.S. utilities have begun preparing least-cost, or integrated resource plans. Although the approaches to integrated resource planning vary, most have the following components in common:

- Research and evaluation of all available resource options, with specific focus on demand-side options (such as energy-efficient lighting);

- Broad consideration of the costs associated with various resource options, often including social and environmental costs;

- Emphasis on preparing for uncertain future events through the development of robust resource portfolios;

- Cost-recovery and other incentives for utilities to invest in programs that save energy and/or reduce the need for production capacity; and

- Greater public participation in the review and approval of resource plans.

National Overview

Because Hawaii is at the early stages of integrated resource planning, it is useful to review the trends and development in other states. A recent nationwide survey sponsored by the U.S. Department of Energy revealed several key findings: (1) the relative emphasis placed on supply- and demand-side options during the planning process is expected to have a significant impact on the mix of resources ultimately selected for the resource plan; (2) during plan preparation, the broader the range of inputs received from interested parties within or outside the utility, the greater the opportunity for the consideration and possible adoption of resource options that serve a variety of interests; (3) the criteria used to assess available options are

likely to influence the contents of the resource plan; (4) the uncertainty analysis technique used during the plan preparation, and the way in which the results of this analysis are used, are expected to help determine the nature of the plan that is developed; (5) the extent to which action plans or other short-term planning documents follow from the long-term plan is important, because it is through the performance of the specific tasks included in short-term plans that long-term plans are implemented; and (6) the resource options selected for a long-term resource plan can affect the utility and other interested parties for many years to come.[21] Exhibit 18 indicates the states that have or are developing IRP programs.

Special Considerations for Hawaii

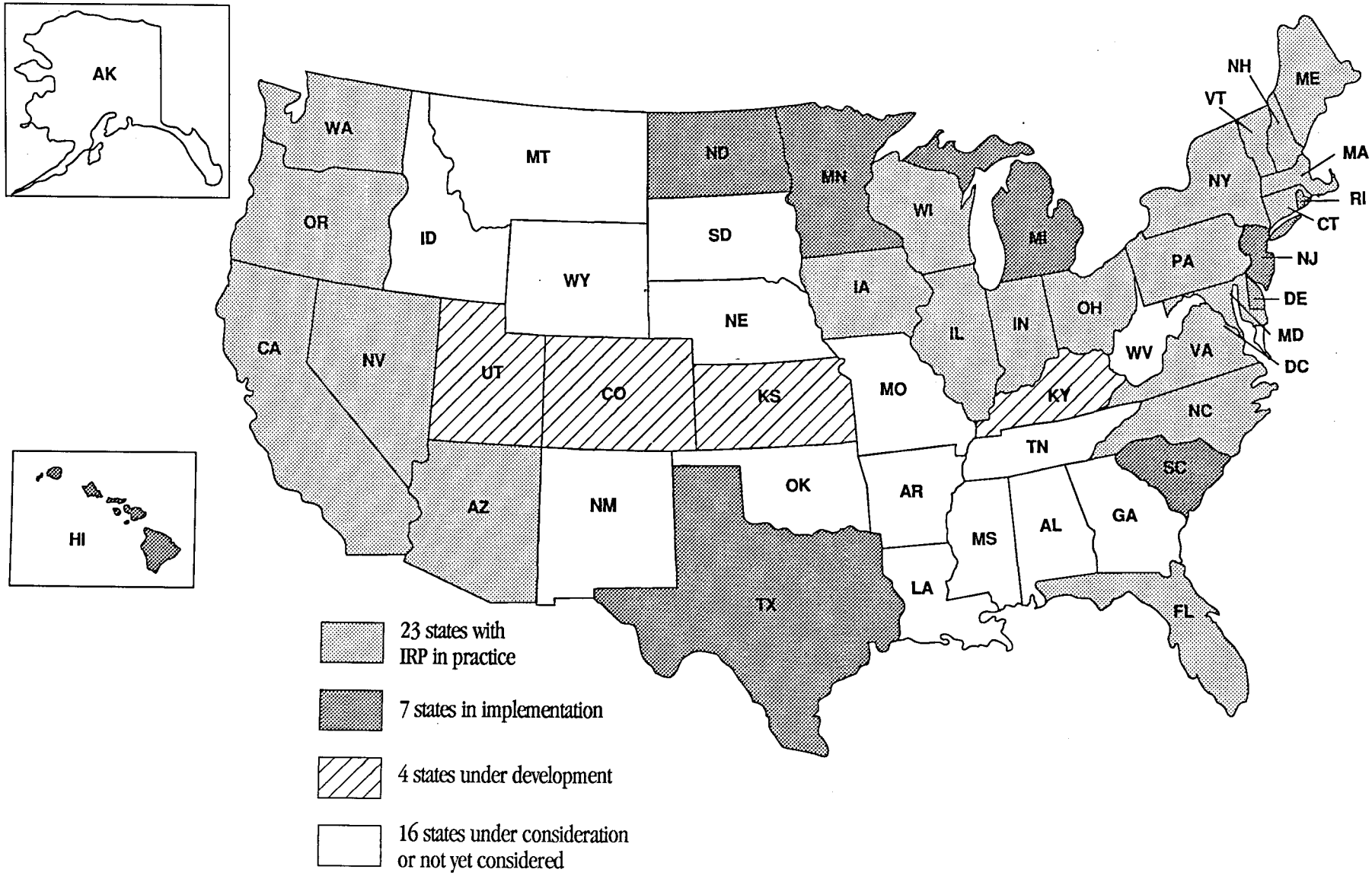
A 1989 study on IRP for Hawaii identified several unique characteristics of its current utility planning relative to mainland utility efforts.[22]

- Hawaii's mild climate virtually eliminates the need for space heating and reduces space cooling needs. Major electrical end-uses in the residential sector are lighting, appliances and water heating (solar and gas water heating are also prevalent). Commercial office buildings, hotels and some multi-family dwellings have cooling loads.
- The relatively small size of Hawaii's electric utilities and their relatively small system loads mean that certain large supply-side power systems are precluded as resource options and that the costs of pilot demand-side programs are recovered over a small customer base. Research, development and demonstration of untried resource options are limited by each utility's available investment capital.
- Demand for electricity is growing at a rate greater than 2% per year, with much of the new load coming from resorts where energy costs represent a small portion of overall operating expenses.
- The utilities operate separate, non-interconnected grids, precluding opportunities for shared resources and bulk capacity purchases.
- SNG is produced as a byproduct of the petroleum refining process, with some propane being imported as a refined product.

[21] Schweitzer, Yourstone, and Hirst. *Key Issues in Electric Utility Integrated Resource Planning: Findings from a Nationwide Study.* Oak Ridge National Laboratory, sponsored by the U.S. Department of Energy, April 1990.

[22] Synergic Resources Corporation. *Integrated Resource Planning in the State of Hawaii.* Prepared for the Hawaii Public Utilities Commission, August 1989.

EXHIBIT 18: States Involved in Electric Utility Integrated Resource Planning



Source: Edison Electric Institute, November 1990.

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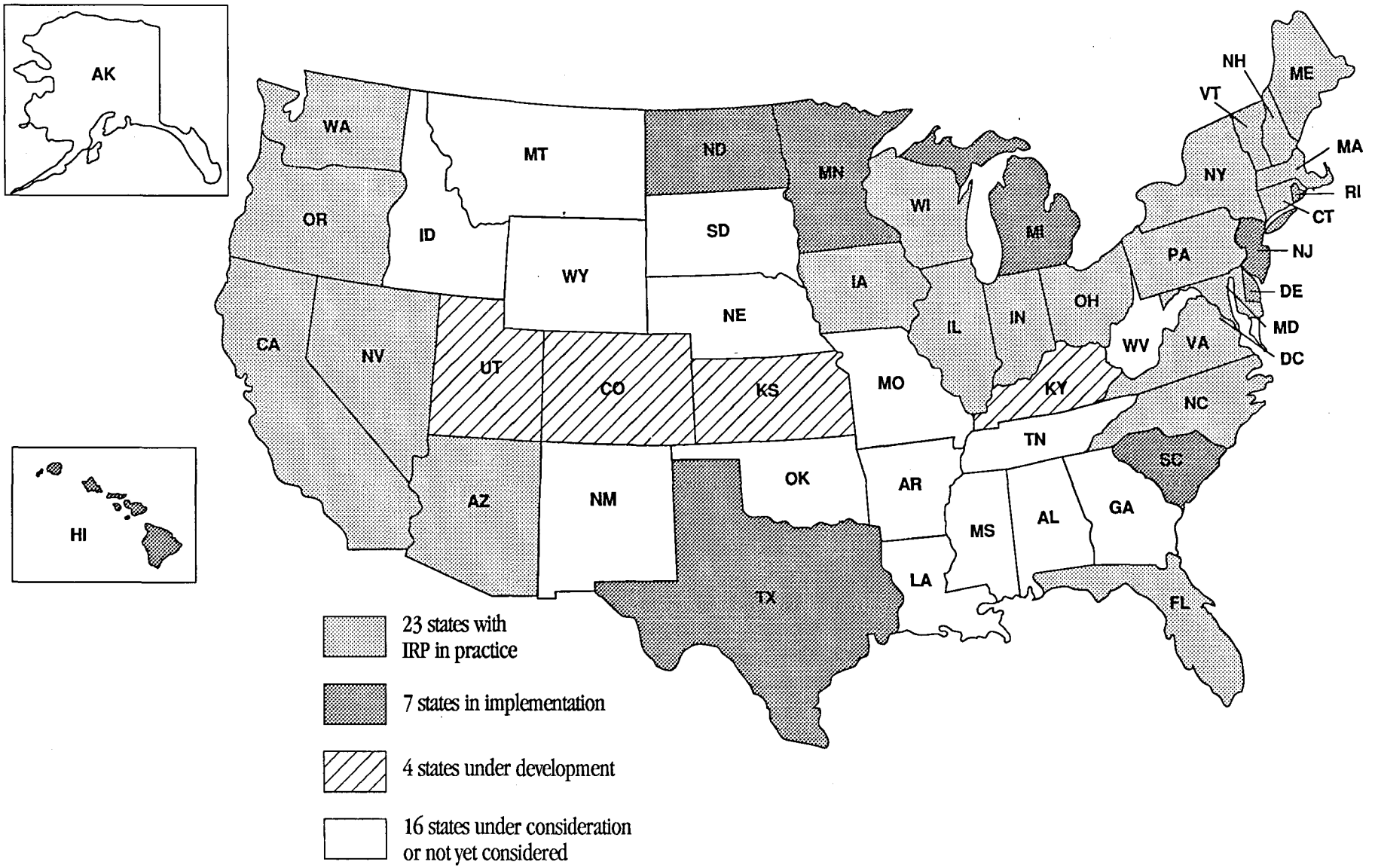

Source: Edison Electric Institute, November 1990.

The Collaborative Process

During the course of the PUC IRP proceeding (Docket No. 6617), 20 of the 25 parties to the proceedings formed a collaborative to: 1) develop a documented consensus among all parties on as many of the issues, broadly construed, in Prehearing Order No. 10757 as possible; 2) provide a forum where parties to the integrated resource planning investigation can exchange ideas and express/discuss their concerns relating to the integrated resource planning process; and 3) foster the understanding and clarification of each party's position regarding the issues.

[THE FOLLOWING SECTIONS HAVE BEEN TAKEN FROM THE COLLABORATIVE'S SUBMISSION TO THE PUC. THESE SECTIONS WILL BE REVISED PENDING THE PUC'S FINAL RULING.]

Collaborative Objectives

(A) To develop a documented consensus among all parties to the integrated resource planning Investigation on as many of the issues, broadly construed, in Prehearing Order No. 10757 as possible;

(B) To provide a forum where parties to the integrated resource planning Investigation can exchange ideas and express/discuss their concerns relating to the integrated resource planning process; and

(C) To foster the understanding and clarification of each party's position regarding the issues.

Principle #1: Goal of Integrated Resource Planning in Hawaii

The goal of integrated resource planning in Hawaii is to assure that consumer energy needs are met in an efficient and reliable manner, at the lowest reasonable cost. The determination of "lowest reasonable cost" shall take into consideration costs to consumers of utility services, as well as environmental, cultural, economic, and other costs to society associated with the development of a particular resource or mix of resources.

Principle #2: Responsibility for Resource Planning

The electric and gas utilities will prepare and implement their integrated resource plans. Government agencies and public constituencies should have opportunities to provide input to the utility integrated resource planning processes, including opportunities to review integrated resource plan proposals.

Principle #3: Role of the Public Utilities Commission

The Public Utilities Commission's roles and responsibilities in integrated resource planning shall include:

1) Deciding upon utility integrated resource plans on behalf of the State of Hawaii;

2) Maintaining a formal docket for filing of documents relating to each utility integrated resource plan, from the beginning to the end of each integrated resource planning cycle;

3) Promoting public involvement throughout the integrated resource planning process; and

4) Promulgating rules and adjudicating differences among parties in all integrated resource planning proceedings.

Principle #4: Role of State and County Agencies

State and County government agencies having statutory interests that are affected by utility integrated resource plans should participate in the integrated resource planning process, and review resulting utility integrated resource plans. Hawaii's integrated resource planning framework shall provide the opportunity for the participation of these agencies.

Principle #5: Public Participation

Integrated resource planning shall be an open public process. Hawaii's integrated resource planning framework shall provide the opportunity for public participation in the development of integrated resource plan proposals and approval of integrated resource plans by the PUC.

Principle #6: Advisory Groups

The integrated resource planning framework should provide for advisory groups, an advisory group for each county, public input throughout the process, and public input independent of the advisory groups.

Principle #7: Relationship to Other Societal Concerns

Each utility's integrated resource plan shall conform with state and county environmental, health, and safety law and formally adopted plans, and shall give adequate consideration to impacts upon existing community lifestyles.

Principle #8: Financial Integrity of Utilities

The integrated resource plan for each utility shall take into consideration the financial integrity of the utility.

Principle #9: Utility Incentives for Demand-Side Management

A combination of removing current disincentives, along with establishing properly constructed incentives, should be used to encourage and reward aggressive utility pursuit of demand-side options.

Current disincentives include the lack of mechanisms for the timely recovery of:

1) Appropriate demand-side management costs; and
2) Revenues lost due to successful demand-side management programs.

Incentive mechanisms should be structured so that investments in appropriate and effective demand-side management programs are at least as attractive to the utilities as investments in supply-side options.

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Principle #10: Framework Guidelines

Hawaii's integrated resource planning framework should specify:

1) The key integrated resource planning steps;
2) Factors to be considered in each key step;
3) Guidelines or criteria describing the boundaries of acceptable performance or outcome for each key step; and
4) Guidelines or criteria for describing the boundaries of acceptability for the plan as a whole.

Where appropriate, the framework should identify the general methodologies or types of methodologies to be used in each key step.

Principle #11: Utility Size and Capability

The integrated resource planning framework shall take into consideration the size and capabilities of each utility.

Principle #12: Planning Horizon

The planning horizon for integrated resource plans developed under the Hawaii integrated resource planning framework should be at least 20 years. The planning horizon for the action plans should be 3 years.

Principle #13: Costs and Benefits to be Considered in Integrated Resource Planning

The following costs and benefits shall be considered when evaluating resources, and their effectiveness:

1) The direct and indirect financial costs and benefits of bringing to realization the supply- and demand-side resources necessary to fulfill consumer energy needs; and

2) The costs and benefits associated with social, cultural, economic, environmental, and other externalities.

The costs and benefits of all resource options shall be considered on a life-cycle cost basis, whenever possible. Consideration shall not be limited to costs and benefits that can be quantified.

Principle #14: Energy Resource Options to be Considered

All feasible supply- and demand-side resource options appropriate to Hawaii and available within the years encompassed by the integrated resource planning horizon shall be considered in the development of utility integrated resource plans.

Principle #15: Measures of Cost Effectiveness

The measures of cost effectiveness supporting comparisons of supply- and demand-side resources shall address the following costs and benefits specified in Principle #13, and shall evaluate cost-effectiveness from a variety of perspectives, including those embodied in the utility, ratepayer, non-participant, total resource cost, societal, and other tests.

Principle #16: Evaluation of Integrated Resource Plans

Utility integrated resource plans shall include an evaluation component that is subject to public review and PUC approval.

Principle #17: Demand-Side Management Pilot Programs

Demand-side management pilot programs can contribute to integrated resource planning effectiveness in the following ways:

1) Testing the technical feasibility, management complexity, and public or consumer acceptability of specific demand-side resource options that are unproven in Hawaii;

2) Developing data on the contributions to fulfillment of consumer energy needs that can be expected from specific demand-side resource options; and

3) Providing experience in the planning, execution, and evaluation of programs for developing specific demand-side resources.

Hawaii's integrated resource planning framework should accommodate appropriate demand-side management pilot programs by utilities, government agencies, and other entities. Utilities should be authorized and appropriately compensated to implement initial pilot demand-side management programs in the process of developing their initial integrated resource plan.

[THIS ENDS THE SECTION DRAWN FROM THE IRP COLLABORATIVE.]

Recommendations

In addition to the formal proceedings at the PUC, the EREDH Task Force also addressed electric utility planning and regulation as a functional area affecting the commercial development of renewable energy and energy efficiency. The following recommendations have been developed independent of PUC Docket No. 6617:

Hawaii should examine ways to establish and update renewable energy and DSM preference in utility regulations to reflect the external costs (e.g., environmental costs) avoided by not using traditional fossil fuels. This should begin with research on approaches used in other jurisdictions to incorporate the external costs of oil- and coal-fired power generation. Legislative or regulatory action should be recommended, using as a basis the research on determining the most appropriate approach for Hawaii. This is a near- to mid-term recommendation.

The regulated electric utilities should extend DSM programs to Federal, State and County government facilities. The participating agencies should cost-share DSM program implementation at their facilities. The utilities should conduct energy audits on representative facilities and pre-screen DSM investments for participating agencies. This is a mid-term recommendation.

The ERC should assign the responsibility to DBED - Energy Division, or the new energy agency, to establish a utility DSM information center. The center should collect and disseminate energy end-use data and information on DSM program design, implementation and evaluation from experience outside Hawaii, as well as that gained through electric and gas DSM programs in the State. Funding for the initiative should come from the State. This is a near-to mid-term recommendation.

4.4 ENHANCING ENERGY EFFICIENCY AND RENEWABLE ENERGY DEVELOPMENT

Renewable energy sources (e.g., biomass, geothermal, hydroelectric power, solar, wind, ocean energy) represent Hawaii's indigenous resource base. The cost of exploiting the resource base, the resource concentration, the status of the technologies used to convert renewable energy resources into useful energy and the market readiness of specific applications combine to determine their relative cost-effectiveness. In many respects, Hawaii has become a living laboratory for the development of renewable energy.

In recent years, attention has turned to energy-efficiency improvements as cost-effective alternatives to increasing energy production in meeting demands for energy services. While awareness of energy conservation and energy efficiency is growing, their potential in Hawaii has yet to be determined. Utility IRP is one attempt to institutionalize the recognition that energy savings can be an important component of Hawaii's energy portfolio.

Because of the environmental and security benefits of energy efficiency and renewable energy options, Hawaii has explicitly included the research, development and use of renewable energy technologies, as well as prudent use of energy supplies and energy-efficient practices and technologies, as the foundation of its efforts to meet its energy self-sufficiency objectives. While there have been efforts to develop these resource options, the energy community as a whole, and the HEP program participants in particular, see a need to enhance energy efficiency and renewable energy development. Exhibit 19 summarizes spending for renewable energy and energy conservation development by DBED, Hawaii Natural Energy Institute (HNEI), and Pacific International Institute for High Technology Research (PICHTR) in nominal dollars.

EXHIBIT 19: Alternative Energy and Conservation Development Spending (1981-1989)
($000)

Resource/Technology	1981	1982	1983	1984	1985	1986	1987	1988	1989	TOTAL	Percent
Geothermal	1,306	303	293	447	655	197	257	288	1,174	4,920	7.0%
Deep Water Cable	300	850	580	1,340	175	1,604	200	0	1,000	6,049	8.6%
OTEC	3,774	4,084	2,666	1,616	1,567	667	1,838	2,600	4,491	23,301	32.9%
Biomass	472	175	302	330	543	664	213	783	2,727	6,209	8.8%
Solar	276	530	425	142	83	35	35	23	50	261	2.6%
Wind	186	189	253	5	22	9	410	116	358	1,548	2.2%
Hydropower	0	0	30	30	0	0	0	75	110	245	0.3%
Transportation	109	73	50	50	50	50	61	604	462	1,509	2.1%
Other	200	68	65	154	375	274	1,037	1,430	3,334	6,937	9.8%
Conservation	2,757	1,508	2,175	910	1,776	1,373	1,660	1,781	4,253	18,193	25.7%
TOTAL	9,380	7,780	6,839	5,024	5,246	4,873	5,697	7,727	18,170	70,736	100.0%

Source: DBED, HNEI, and PICHTR records.

Conservation and Energy Efficiency

The energy intensity of Hawaii's economy has declined since 1970. In other words, less energy is required to produce the same level of economic output. Although much of this is due to structural changes in Hawaii's economy (e.g., shift toward a service economy), much has been learned about the forces contributing to more efficient energy use in the U.S. that is relevant to Hawaii, including:

- The ability to reduce consumption in response to higher energy prices in a relatively quick and flexible manner;
- The availability of energy-efficient technologies and information in the marketplace played a big role in the rate of acceptance and adoption of new energy savings measures;
- The economy's response to changing energy market involved both technological and behavioral changes;
- Application of energy efficiency technologies by individuals and business often produce side benefits, such as lower costs of production and improved environmental quality;
- The outlook for continued energy efficiency improvements is clouded by uncertainty about future energy prices, the market acceptance of emerging technologies, and the degree to which concern about environmental problems may cause changes in energy use patterns; and
- The understanding of the causes and effects of energy efficient choices allows the more confident inclusion of conservation as a resource in long-term energy planning.

Cogeneration

Cogeneration is the production of heat energy and electrical or mechanical power from the same fuel in the same facility. Cogeneration can significantly improve the conversion efficiency of fuel to useful energy. In Hawaii, cogeneration is prevalent in the sugar industry and other agricultural operations such as macadamia nut farming, and petroleum refineries. Several cogeneration projects are under development or operating that sell both steam and electrical energy on a commercial basis.

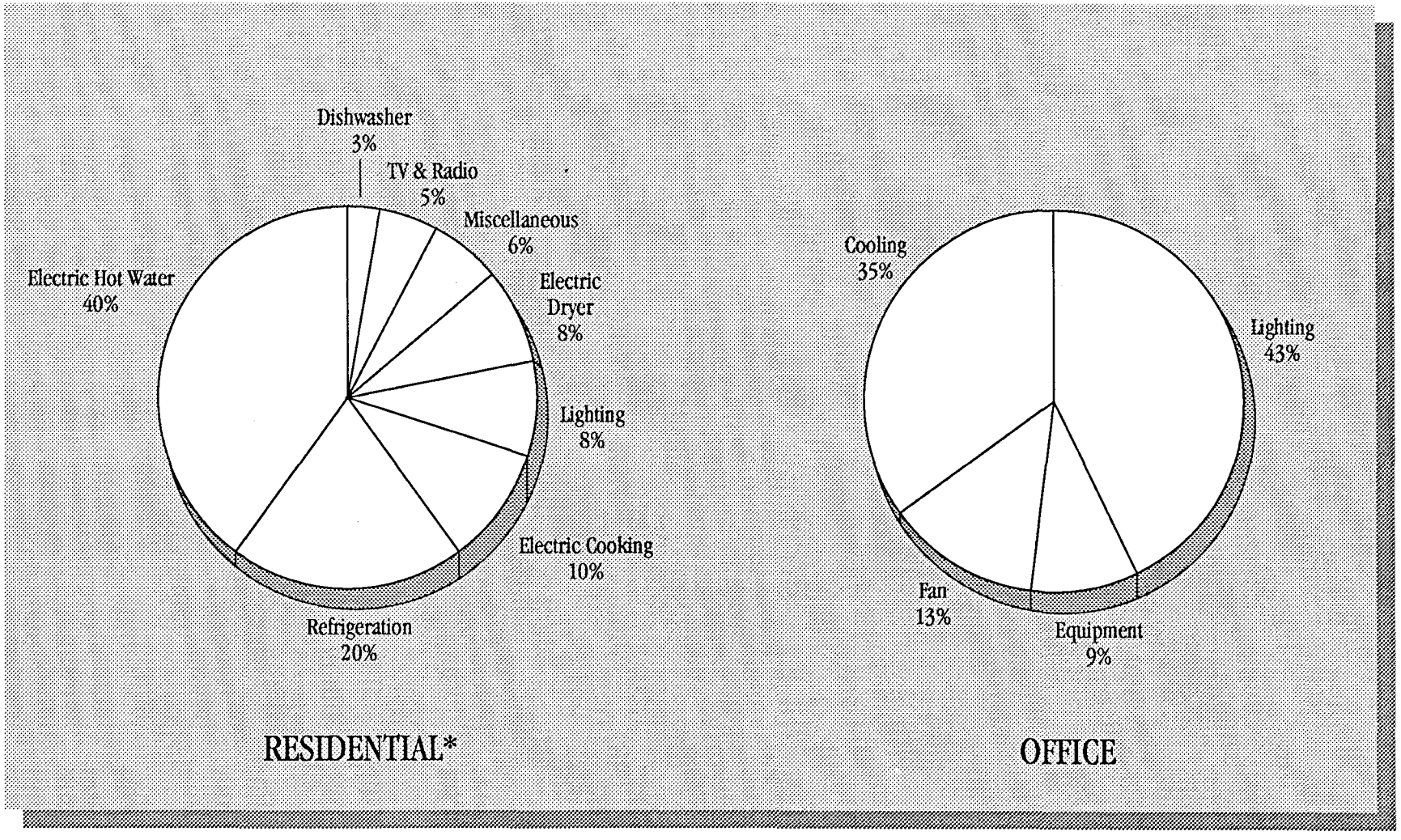
Building Efficiency

Hawaii has made strides to improve the energy efficiency of its existing and new building stock. Technical and financial support has been made available for the retrofit of both public and private structures. With the advent of new, more energy efficient technologies, Hawaii has the opportunity to further improve the efficiency of residential and commercial buildings. Hawaii has adopted the national energy-efficiency standards for lighting and household appliances. The State has prepared draft energy-efficiency building codes for residential and commercial buildings. Exhibit 20 shows the relative percentages of energy end-use in typical residential and office buildings in Hawaii.

Demand-Side Management

As mentioned in the Section 4.3, DSM is a critical component of utility IRP. DSM programs are designed with the intent to reduce or adjust customer consumption of energy. For some U.S. utilities, DSM represents

EXHIBIT 20: Residential and Office Energy Use



* Typical single family house without air conditioning

Source: *Hawaiian Design*, Department of Business, Economic Development and Tourism, 1990.

the largest and fastest growing component of their resource plan. Each of the utilities have conducted preliminary screening of DSM options and have proposed pilot DSM programs. For example, Kauai Electric Division has proposed a residential lighting program, while HECO, Maui Electric Company and Hawaii Electric Light Company have proposed a lighting program for commercial, industrial and institutional customers. The proposed programs await approval by the PUC.

Renewable Energy Development

Renewable energy sources are a class of energy resources that are continuously or periodically renewed. In Hawaii, renewable energy resources include solar, wind, hydropower, ocean thermal energy conversion, wave power, and geothermal energy. Biomass is renewable if the organic matter is regenerated or reproduced at a rate at least equal to the rate at which it is being converted to useful energy. Geothermal energy is renewable to the extent that the underground heat source is continuous and the hydrothermal resource is replenished through reinjection of water.

Biomass Energy

Biomass has been an important source of energy for process steam and electricity in Hawaii's sugar mills for many years. Bagasse (sugarcane residue) and other agricultural wastes have been burned to provide both on-site energy needs as well as energy sales to local utilities during periods of excess supply. The 1,600 ton per day (58 MW net) H-POWER municipal solid waste plant began operation in 1989 on Oahu. A medium-Btu gasifier is being designed for the Paia Sugar Factory on Maui. Research and analysis is also being done on the potential for production and use of dedicated energy crops to provide alternative liquid transportation fuels.

Geothermal Energy

In volcanically active Hawaii, geothermal resources are believed to offer a significant near-term supply of firm electric power. Based on limited testing, the resource is estimated to be about 75-100 MW in the Puna area of the Big Island alone. Two private companies have plans to develop 25 MW each of geothermal capacity in the area. They are conducting their own exploration and resource characterization tests on sites that have been identified and have received permits. The HNEI is drilling scientific observation holes in the Kilauea Volcano's Rift Zone to evaluate geothermal potential.

Hydroelectric Power

Hawaii's porous rock and flashy hydrology make harnessing rivers and streams difficult. Twenty hydropower projects are operating throughout the islands for a combined generation capacity of about 19 MW. Another 67 MW of projects have been identified on the Big Island (Wailuku and Honolii streams on the Hilo side), Maui (Wailua Iki Stream), and Kauai (Lumahai, Wailua, Hanalei, and Wainiha streams). Additional generating capacity can also come from upgrading and refurbishing existing hydropower stations. Utility hydropower projects range from 50 to 73 years old.

Ocean Thermal Energy Conversion

OTEC is considered to offer Hawaii the greatest potential, next to geothermal, over the long term. PICHTR and the U.S. Department of Energy have conducted extensive testing of component parts, including heat

exchangers, at Natural Energy Laboratory of Hawaii Authority facilities on the Big Island. Hawaii's sub-tropical location and high insolation provide it with an annual average surface-to-deep water temperature difference of 21 degrees Celsius. Keahole Point on the west coast of the Big Island and Kahe Point on the west coast of Oahu have been identified as prime areas for OTEC installations.

Solar Energy

The various solar conversion technologies stand at different stages of commercial readiness. The commercial development of solar energy took off in the late 1970s and early 1980s with combined state and federal tax incentives. An estimated 50,000 residential and institutional hot water systems are in place and operating within the State. Over 500 small PV systems are operating. A 20-kW PV system is interconnected with the Maui Electric Company grid. A state-wide competition of PV-powered cars has been held. A private company has been contracted to conduct a site identification for a solar thermal electricity generating system based on a commercial design used in California. It should be noted that a major impediment to the development of larger-scale solar systems for generating grid electricity is the high cost of land in Hawaii.

Wave Energy

Data gathered from wave gauges is essential to evaluations of Hawaii's wave energy potential. Although nine wave gauges have been or are deployed in Hawaiian waters for one or more years, three are in water depths that are greater than 1000 meters, where mooring costs would be prohibitive to wave energy development, and three are on island coasts that are sheltered from northwest Pacific swell and northeast trade wind waves, which are the major components of Hawaii's wave energy resource. Three sites (Barking Sands area of Kauai, Makapuu Point on the east cost of Oahu, and Upolu Point on the north coast of the Big Island) offer the greatest potential.

Wind Energy

Hawaii's wind energy potential is considered among the best in the world, with its mountainous contours and the northeasterly trade winds which prevail over 70% of the time. Small wind energy conversion (SWECS), i.e., windmills, are installed on most of the islands, and commercial wind farms exist on both Oahu and the Big Island for a combined installed generating capacity of 28 MW. The largest wind turbine in the world (MOD-5B) is in operation at Kahuku on Oahu.

Recommendations

The recommendations to enhance the commercial development of renewable energy and energy efficiency are:

- **Hawaii should prepare and publish a comprehensive renewable energy and energy efficiency research, development and commercialization strategy with specific resource assessment, basic and applied research, and commercialization and implementation activities.** The first step is to develop an R&D planning and prioritization process with input from funding agencies, R&D institutions and private energy companies. The R&D plan would include specific milestones for bringing energy technologies out of the laboratory and into the marketplace, where they would no longer need government support. Priority should be given to

near-commercial technologies than can have a significant impact and are compatible with Hawaii's resource base and energy infrastructure, i.e., supply and delivery systems. The Strategy should feed into long-range energy planning and guide R&D efforts in Hawaii. This is a mid-term recommendation.

- **Hawaii should establish a data base of information upon which to analyze renewable energy options.** DBED - Energy Division or the new energy agency should develop an information system to collect and report cost and performance data for renewable energy, conservation and transportation alternatives. The data base should be accessible throughout Hawaii. This is a near- to mid-term recommendation.

- **Hawaii should establish guidelines/standards for renewable energy installations with appropriate public input.** The State should build on similar guidelines/standards in other jurisdictions and allow renewable energy companies and consumers to comment on the draft regulations. The State should seek public input, where appropriate, in development of guidelines and standards. Once finalized and accepted, the State should institute a mechanism for verification and enforcement. This is a mid-term recommendation.

- **Hawaii should implement the energy efficient building codes being prepared by DBED - Energy Division through hiring building code professionals in each of the counties.** The Energy Division, in its role as sponsor of the new codes, should have prime responsibility for ensuring the codes are adopted and implemented. The ERC should require a report within 120 days of the approval of the codes and county building code agency adoption of the codes. This initiative should include an effort to educate developers, architects, builders, and financial institutions. This is near- to mid-term recommendation.

- **Hawaii should mandate cost-effective use of alternate energy and energy-efficient domestic hot water for public housing units.** DBED - Energy Division or the new energy agency would conduct a preliminary analysis to identify the characteristics of cost-effective solar and energy-efficient hot water installations and identify which housing units would be covered by the requirement. Together with the Hawaii Housing Authority, DBED - Energy Division or the new energy agency should prepare analysis and procurement guidelines (based on the National Bureau of Standards' "Least Cost Energy Decision Guidelines"). This is a mid- to long-term recommendation.

- **Hawaii should modify the license-C classification to allow solar professionals to do complete domestic hot water and photovoltaic system installation.** The solar hot water heating system contractor license subclassification (C-61) requires a licensed plumber as well as the solar installer. There is no license specifically for PV system installations. By allowing one qualified contractor to install these systems, this initiative is expected to result in lower system costs for consumers and a single point of contact for equipment/installation problems. The solar contractors must be licensed and bonded to avoid safety and other liability concerns. This is a near- to mid-term recommendation.

- **Hawaii should, with broad public input, investigate the potential for dual (compatible) and acceptable use of State-owned agricultural and conservation zoned land for siting renewable energy projects.** A study should be conducted by DBED - Energy Division or the new energy agency to identify acceptable sites for project development and provide attractive terms for leasing land. The study results would be presented to the Land Use Commission and the general public. This is a mid-term recommendation.

- **Hawaii should assist the county public works departments to assess the energy implications of solid waste management plans.** Pursuant to the Solid Waste Management Act of 1991, the county plans will consider recycling, waste minimization, and waste-to-energy conversion, as alternatives to landfilling. DBED - Energy Division or the new energy agency should provide technical assistance on energy-related solid waste matters. This is a near-term initiative.

- **Hawaii should identify and designate streams and river basins that are suitable for hydropower development.** Based on a list of potential sites developed by DBED - Energy Division or the new energy agency, DLNR, together with the county planning and siting agencies, should identify which sites should be considered further for development. For those sites not included in the inventory of acceptable sites, DLNR should indicate what environmental constraints or competing interests exclude the site from further consideration. DBED - Energy Division or the new energy agency should compile the DLNR and county findings and disseminate the information to prospective developers. This is a mid-term recommendation.

- **Hawaii should launch a major state-wide energy education program complete with public service announcements, demonstrations, technical and general curricula for local schools, fact sheets, etc.** The State should form an education committee consisting of the utilities and other energy companies, state and county education departments, and environmental and other public interest groups. The State should serve to coordinate individual efforts, as well as conduct common educational and information dissemination activities. This is a near- to mid-term recommendation.

4.5 TRANSPORTATION ENERGY USE

The development of a transportation energy policy presents formidable challenges. Not only are there limited options for fuel substitution, but both aviation and marine (bunker) fuels are often outside the State's policy control. Aviation fuel requirements represent over 42% of total petroleum consumption and two thirds of transportation demand in the State. Although aviation fuel is by far the largest component of refined petroleum products, there is relatively little that the State can do to influence its consumption. For the most part, Hawaii will have to depend on energy efficiency improvement resulting from competitive pressures to increase passenger load factors and the introduction of new aircraft. For example, between 1970 and 1988, the average annual increase in energy use was only 2.3%, while passenger miles and cargo-ton miles increased 6.9% and 6.1%, respectively (see Exhibit 21). The passenger load factor has grown from just under 50% to nearly 63% during this period.[23]

[23] *Transportation Energy Data Book: Edition 11.* Oak Ridge National Laboratory, January 1991.

However, several important factors will influence the near- and medium-term demand for aviation fuels. New aircraft being introduced into the national and international fleets will be substantially more fuel efficient than existing planes. The efficiency of new aircraft introduced in 1989 is approximately 50 seat miles per gallon (SMPG) of jetfuel. Aircraft delivered in the 1990s are expected to achieve 65-80 SMPG, and current research indicates that 100-150 SMPG is feasible in the near term. As these newer aircraft are increasingly used on Hawaiian and non-stop Trans Pacific routes, the State's needs for jet fuel should stabilize.[24]

Although the introduction of new aircraft may eventually result in declining jet fuel demand, the near-term conversion of military aircraft from naphtha-based fuels to conventional kerosene-based jet fuel may have the opposite effect. Military aircraft currently consume over 10% of Hawaii's aviation fuel. The switch from naphtha-based fuels to conventional jet fuels will increase jet fuel demand by nearly 12% and may cause short-term changes in the State's petroleum import/export balance. Thus, jet fuel demand in Hawaii is likely to reach a peak in 1992-93 and then begin a slow decline as new planes are introduced. Hawaii's oil refineries have the capability to adjust to reductions of as much as 30% in naphtha-based products.

The demand for road fuels, principally motor gasoline and diesel, is an area of primary energy policy concern in Hawaii. The experience of the last decade suggests that Hawaiian drivers, like their mainland counterparts, are relatively insensitive to marginal changes in the pump price of fuel. Rather, the demand for road fuels is influenced by the fuel characteristics of the private vehicle fleet and by the availability of public transportation.[25] The requirements for road fuels can, over the long term, be fundamentally altered by innovative urban and land-use planning, which makes it possible for people to work near their homes and avoids energy-wasteful commuting.

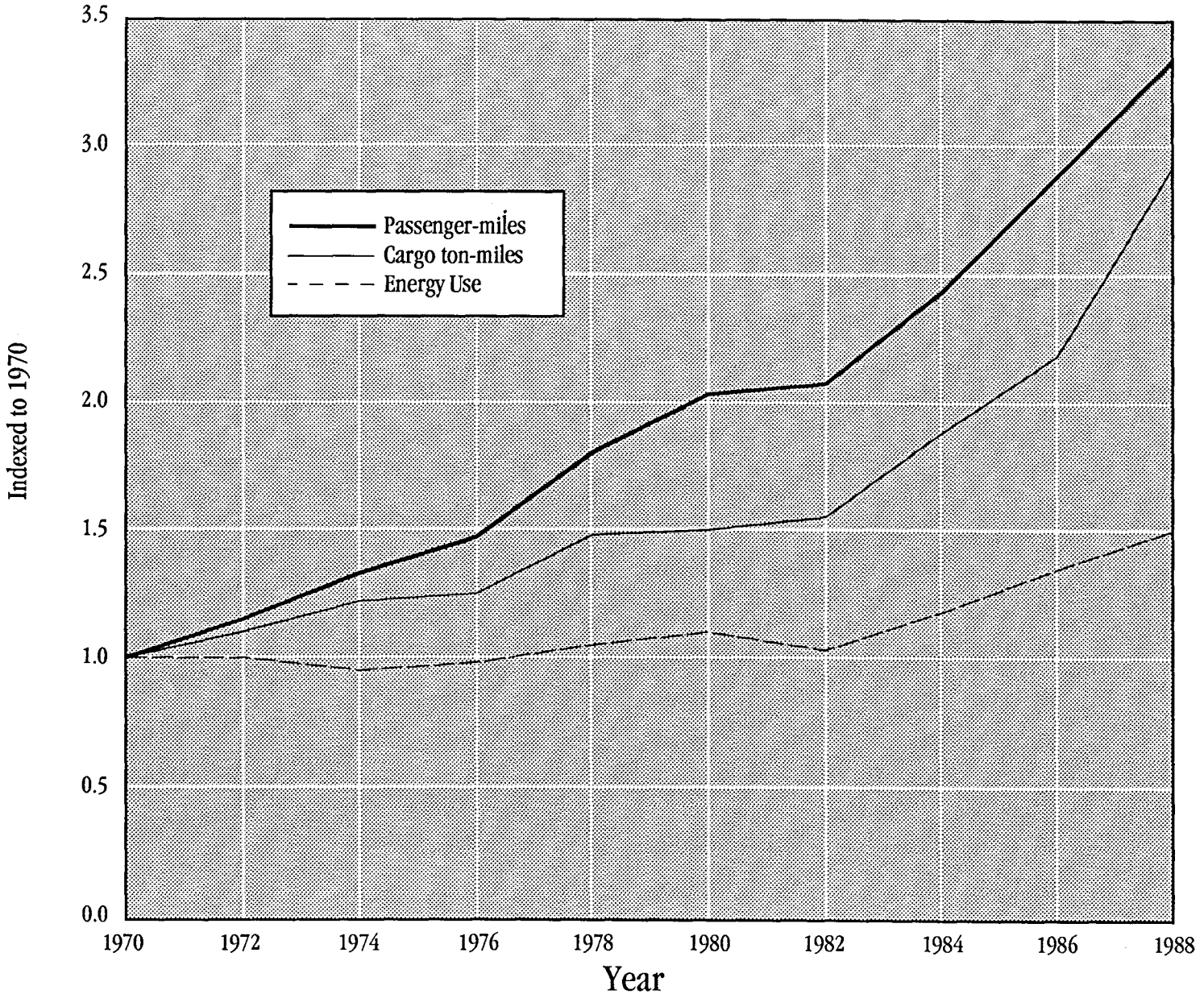
It is becoming apparent that U.S. cities, including those in Hawaii, cannot continue to support today's urban patterns, which require workers to commute from their suburban homes to downtown work places. This problem is particularly acute in Honolulu, where there are few alternative commuting routes and traffic congestion is rapidly approaching critical levels. The City and County of Honolulu has proposed a rapid transit system and the State Department of Transportation (DOT) has proposed a water ferry system. Recognizing the inherent limitations of Hawaii's surface infrastructure and road system, the State's transportation officials have proposed new urban planning concepts designed to move workplaces to the suburbs. Called "Telework Centers," this suburban workplace concept has drawn international attention and has had a significant impact on the commuting habits and transportation energy requirements of participants. Early assessments of the project suggest that participants have reduced travel time by 78%, decreased transportation costs by 59%, and reduced fuel consumption by nearly 30%.[26]

[24] In 1989, 13% of all airline passengers arriving in Hawaii were in transit to other locations.

[25] Public transportation is available on Oahu, Kauai and Hawaii. In 1990, there was an estimated 75 million passenger-trips and 17 million bus service miles on Oahu. Passenger-trips totaled 127,000 and 91,000, and bus service miles totaled 244,000 and 305,000 on Hawaii and Kauai, respectively.

[26] *Final Evaluation Report of Year One of the Hawaii Telework Center Demonstration Project.* Prepared by SMS Research for Hawaii Department of Transportation, January 8, 1991.

EXHIBIT 21: Energy Intensity of Certified U.S. Air Carriers
(1970 - 1988)



A second factor of potential importance for Hawaii's transportation demand is the emergence of fuel-efficient transportation technologies. Modern advances in automobile and jet engine design have significantly increased the performance of airplanes and cars, thereby reducing the amount of fuel required per passenger mile of transport. While these innovations are beyond the influence of State energy policies, initiatives by the federal government and private equipment suppliers will benefit the people of Hawaii by reducing future demand for transportation fuels.

Hawaii's passenger vehicle fleet has historically been one of the most efficient in the nation. However, the fuel efficiency of Hawaii's passenger fleet has been static in spite of significant increases in the efficiency of the national vehicle fleet. This trend reflects changing sales patterns which favor larger and more powerful passenger vehicles. In addition, the efficiency of foreign cars entering Hawaii has declined.[27] Exhibit 22 compares distances traveled and imputed miles/gallon of gasoline for Hawaii with national data.

EXHIBIT 22: Private Vehicle Mileage and Fuel Efficiency in Hawaii and the U.S.

Year	Mileage/Car		Gallons/Car		Miles/Gallon	
	Hawaii	U.S.	Hawaii	U.S.	Hawaii	U.S.
1980	9019	9141	536	591	16.8	15.5
1985	9027	9560	461	525	19.6	18.2
1989	9062	10382	463	506	19.6	20.5

Source: U.S. Department of Energy, Energy Information Agency, *Monthly Energy Review,* March 1991 and the *1990 State Data Book,* Table 530.

[27] A further contributing factor in the declining fuel efficiency of Hawaii's private vehicle fleet may be related to the soaring sales of new cars to car rental agencies. These rental cars may have a substantially different fuel consumption pattern from the resident-owned vehicle fleet.

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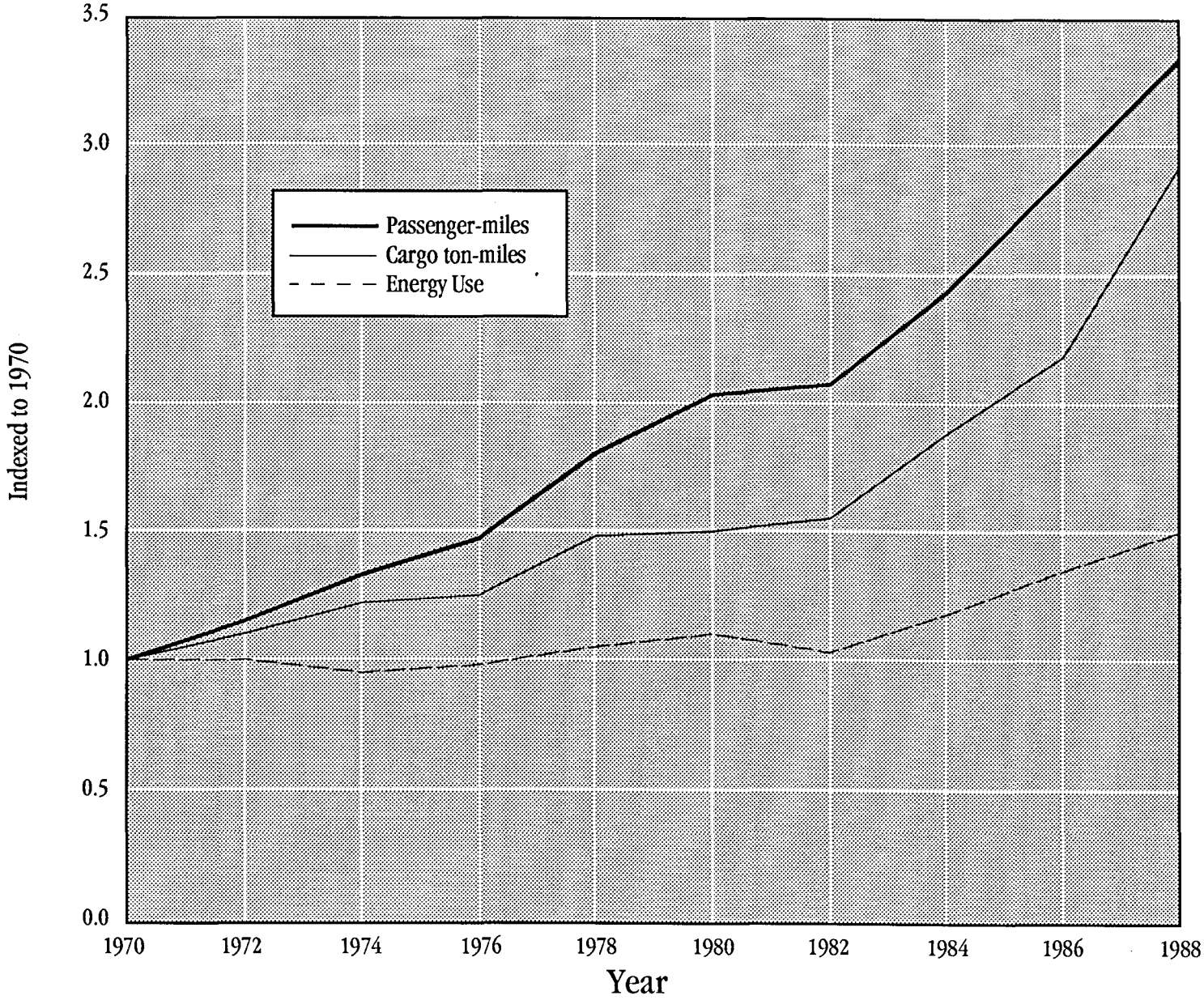

Source: *Transportation Energy Data Book:* Edition 11. Prepared by Oak Ridge National Laboratory, January 1991.

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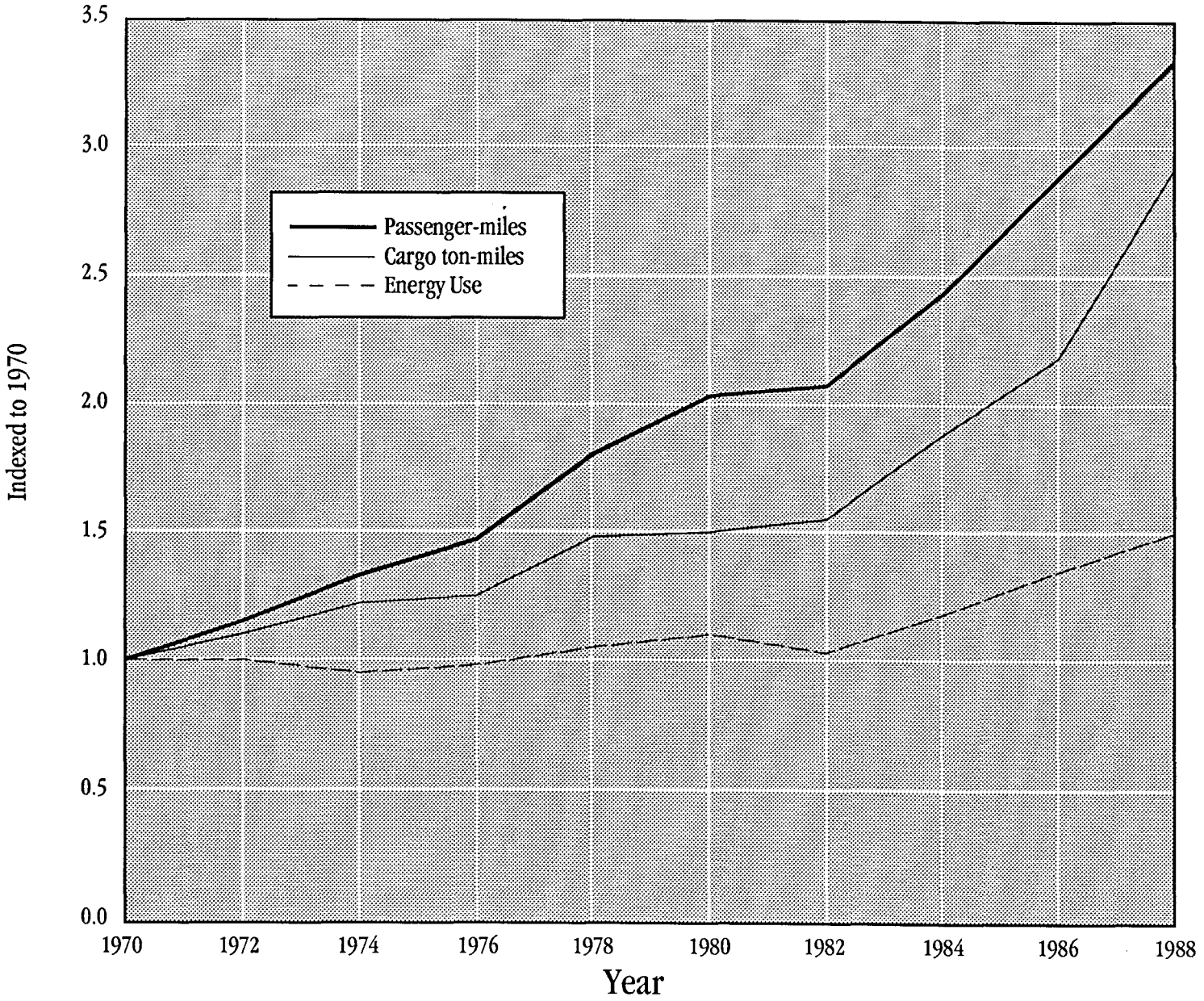

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[27] A further contributing factor in the declining fuel efficiency of Hawaii's private vehicle fleet may be related to the soaring sales of new cars to car rental agencies. These rental cars may have a substantially different fuel consumption pattern from the resident-owned vehicle fleet.

Recommendations

The recommendations for transportation energy use are:

- **Hawaii should analyze the effectiveness of transportation policy options, including public transit, energy pricing and other fiscal policies, and infrastructure changes, that will reduce demand for petroleum based fuels.** DBED - Energy Division or the new energy agency, in consultation with DOT, should conduct the analysis and implement those that prove the most effective. Policy options should include use of incentives and disincentives such as rebates and surcharges on new automobiles, and user fee revenues to support alternate fuel development. The energy implications of alternative transportation modes, such as the proposed water ferry system and rapid transit system, should also be analyzed. DOT's Transportation Functional Plan should include specific (energy related) initiatives called for in the Energy Functional Plan. This is a mid-term recommendation.

- **State, County and Federal governments, and selected private companies, should form a transportation task force to coordinate fleet-wide demonstrations of alternate fuel and energy-efficient vehicles.** The State should prepare a list of ground transportation options complete with technical and cost information on each. At the request of the ERC, a task force should be formed with representatives from appropriate agencies at each level of government and private companies that maintain a corporate fleet to participate in a major "alternative forms of transportation demonstration program." This is a near-term recommendation.

- **Hawaii should expand the telework program and other satellite office facilities.** The State should publicize the energy savings and other advantages of decentralization strategies and encourage public agencies and private companies and organizations to participate. This initiative is included in the Transportation Functional Plan. This is a near- to mid-term recommendation.

- **Hawaii should establish commuter information centers to facilitate commuter ride sharing for government, communities, schools, businesses and hotels/resorts.** This initiative is included in the Transportation Functional Plan. This is a near-term recommendation.

- **Hawaii should assist the counties of Maui, Kauai and Hawaii in the planning, assessment, development, and/or improvement of public transportation systems.** Based on the results of the County-wide Transportation Planning Process, conducted jointly by DOT and the County governments, the State should support and promote public transportation and alternative transportation modes as a means of reducing gasoline consumption. This initiative is included in the Transportation Functional Plan. This is a mid-term recommendation.

- **Hawaii should renew, upgrade and implement the bikeway program.** DOT should work with the counties, bicycling organizations, bike tour operators and communities in this effort. This initiative is included in the Transportation Functional Plan. This is a mid-term recommendation.

4.6 ENERGY EMERGENCY PREPAREDNESS

Hawaii's EEP efforts are predicated on the following three facts:

- Petroleum products dominate the energy supply mix;
- Hawaii's geographic location limits its access to national reserves; and
- Hawaii will have to increasingly turn to imports from politically unstable regions of the world.

According to Hawaii law, the Governor may declare that an energy shortage exists when there is a fluctuation in the supply or demand of any petroleum product that may cause a major adverse impact on the economy, public order, or the health, welfare, or safety of the people of Hawaii and may not be responsibly managed within the conventional free market distribution system. An energy shortage could result from any number of factors including such things as geopolitical events like the recent Gulf Crisis or an emergency that might cause the shut down of one or both of the petroleum refineries.

Hawaii has developed what is considered an effective EEP program to support the Governor in exercising his EEP powers. The Governor has designated the ERC to be his authorized representative to prepare for and manage an energy emergency. The ERC chairs the Governor's EEP Advisory Committee, which is comprised of representatives from Federal, State and County governments, the oil industry, Hawaii's energy utilities, Hawaii's fuel retailers, and other key consumer groups.

To exercise these powers, a four-phase emergency preparedness plan has been developed for implementation in the event of an abrupt change in Hawaii's supply or demand situation. The four phases are: Verification/Information Phase; Implementation of Pre-Shortage Programs Phase; Declared Emergency Phase, during which various allocation measures will be initiated; and Post Shortage Evaluation Phase. Currently, each county is responsible for developing their own EEP plan, and can "opt-out" at the discretion of the Mayor.

The purpose of the State's emergency response plan is to ensure that essential services are maintained and that fuel supplies are allocated in a manner which reflects predetermined policy priorities. The four main emergency response categories are:

- Supply enhancement measures, such as drawdown from the Strategic Petroleum Reserve;
- Coping measures, such as emergency ride-sharing;
- Demand restraint measures, such as stricter enforcement of speed limits; and
- Supply management measures, such as retail sales controls, and a State Fuel Set-Aside Program to ensure that emergency and essential services (e.g., fire, police and ambulance) are maintained.

An essential part of any emergency preparedness strategy is to augment the State's petroleum reserves through increased storage or access to existing federal petroleum reserves. Depending upon the demand scenario assumed, Hawaii's existing commercial petroleum storage capacity is equal to 30-50 days of supply. The movement of additional supplies from strategic reserves on the U.S. Gulf coast to Hawaii is estimated to take 53-70 days. This means that mainland supplies would become available only after Hawaii's supply situation had become critical.

To overcome these logistical problems, it has been proposed that a 10 million barrel (a 90-day supply) regional petroleum reserve (RPR) would be provided through a federally supported program to construct additional storage and finance the acquisition of stocks of crude oil and refined products. These stocks could be used as a buffer for Hawaii and west coast states in the event of a supply emergency. Reasonable state-wide access needs to be a consideration in siting local stocks.

Important arguments in favor of an oil reserve in the islands include: the very high dependence of the State on petroleum; the oil needs of the military, which might equal as much as 40% of total energy demand during a crisis; and the decline of oil reserves in California and Alaska. This decline in west coast production will lead directly to increased foreign oil dependence and result in longer delivery times in the event of an energy emergency. The estimated cost of constructing additional storage for 7 million barrels of crude oil and 3 million barrels of jet fuel range from $80-150 million. The additional oil would be secured from funds now allocated under the national Strategic Petroleum Reserve (SPR) program.

Another potential source of petroleum stocks is the military reserves maintained in Hawaii. Given the changing geopolitical situations in Asia, Hawaii may be able to work with the military to distribute its stocks during an energy emergency that does not involve a military response. However, the closing of military bases in the Philippines may result in an increasing concentration of the military, particularly the Air Force, in Hawaii.

Recommendations

The recommendations for energy emergency preparedness are:

- **Hawaii should develop and implement changes to the State's EEP Statute (Chapter 125C, HRS) and plan.** The EEP statute and plan should: (1) require a biennial review and update of the state and county EEP plans; (2) require state and county plan coordination and consistency; (3) require the development of an energy emergency communications plan; (4) establish a permanent EEP staff within State government; (5) establish a permanent EEP facility to house the Shortage Management and State Fuel Set-Aside Offices within the same building as DBED - Energy Division or the new energy agency; and (6) clarify the administration of the Petroleum Product Control Fund. This is a near- to mid-term recommendation.

- **Hawaii should revise State Administrative Rules (Section 91, HRS) governing the State Fuel Set-Aside Program.** The purpose of the change is to: (1) accommodate otherwise eligible commercial accounts that do not possess the requisite 12-month base period account history; and (2) permit priority certification for emergency services and certain other essential users to obtain fuel without applying through the State Fuel Set-Aside Program during a fuel shortage. This is a near- to mid-term recommendation.

- **Hawaii should review current petroleum product specification laws to determine which, if any, are applicable to a waiver of key product specifications to increase energy supplies during a petroleum shortage.** As appropriate, local refiners should develop recommended product specification waivers to be implemented in the event of a petroleum shortage. This is a near- to mid-term recommendation.

- **Hawaii should assess the need to designate aviation fuels as subject to government control under the State Fuel Set-Aside Program.** This is a near- to mid-term recommendation.
- **Hawaii should urge the Federal government to provide Hawaii with "priority access" to SPR oil in the event of a petroleum supply disruption, until a RPR can be established in Hawaii.** Hawaii would pay the price of the average winning bidder based on the President's auction of the SPR. This is a near- to mid-term recommendation.
- **Hawaii should urge the Federal government to establish a 10 million barrel (90 day supply) RPR in Hawaii.** The State should recommend partial allocation of the Department of Defense stockpiles in Hawaii for civilian purposes. This is a mid-term recommendation.

SECTION 5: INSTITUTIONALIZING THE HEP PROGRAM

The first iteration of the HEP process revealed both the strengths of its design and areas for possible improvement. This chapter is intended to serve as the basis for modifying the HEP Program in future iterations. More important, it serves to guide the State and members of the energy community in institutionalizing this important effort.

5.1 RELATIONSHIP TO THE ENERGY FUNCTIONAL PLAN

The Hawaii State Plan, Chapter 226, HRS, provides a long-range guide for Hawaii's future. It establishes State goals, objectives and policies, and a Statewide Planning System to carry them out. This system requires the biennial development of State Functional Plans that are approved by the Governor.

DBED is responsible for preparing the Energy Functional Plan. This Plan primarily addresses priority actions that should be taken within a two- to six-year period to coincide with the Biennial Budget and Capital Improvement Program budgetary cycles. The "task-oriented" Functional Plan is most useful in describing the discrete activities needed to achieve Hawaii's energy objectives and policies.

The broad scope and extensive public participation in the HEP Program resulted in a shared vision of Hawaii's energy future and the course that the State should take in realizing this vision. However, the HEP Program, by itself, is not sufficient in providing the substantive analysis upon which to make informed policy recommendations. In the future, the Hawaii Energy Plan will contain specific policy recommendations, including budget allocation, and should replace the Energy Functional Plan.

5.2 PROGRAM STRUCTURE AND PARTICIPATION

In its first iteration, the component task forces, committees and work groups of the HEP Program recognized the complexity of energy management and the diversity of interests of the various stakeholders in the State's energy community. They also recognized the need to incorporate knowledgeable and affected parties in the process. In future iterations, the HEP Program will produce the following reports:

- **Hawaii Energy Plan** - The Hawaii Energy Plan, as mentioned above, should replace the Energy Functional Plan. It should contain specific policy recommendations and budgetary requests that should serve as the Governor's energy policy. It should integrate the analysis and findings of several component efforts, including the Energy Emergency Preparedness Plan, the Long-Range Energy Supply/Demand Forecasts, the Energy Technology/Resource Assessment, the Research, Development and Commercialization Strategy, and the Energy Conservation Plan. An EPAC should review the HEP Report and public meetings should be held to seek public input. The EPAC should review the Hawaii Energy Plan components. These component reports should also be made available to interested members of the public.

- **Long Range Energy Supply/Demand Forecasts** - DBED - Energy Division, or the new energy agency, should review and analyze the forecasts of electric and gas utilities and other energy suppliers. From these, DBED - Energy Division, or the new energy agency, should prepare an independent, 20-year forecast of trends relating to energy supply and demand and the social, economic and environmental consequences of these trends.

- **Energy Resource/Technology Assessment** - DBED - Energy Division, or the new energy agency, should prepare an inventory and assessment of the state's energy resources, an assessment of the various technologies potentially available to exploit these resources, and an analysis of the economic, social and environmental consequences of such development and use and their ability to help meet Hawaii's overall energy objectives.

- **Comprehensive Research, Development and Commercialization Strategy** - DBED - Energy Division, or the new energy agency, should prepare a comprehensive strategy and plan for the research, development and commercialization activities, programs, and policies necessary to develop Hawaii's indigenous energy resources in a manner which protects the environment and promotes energy security and sustainable economic development.

- **Energy Conservation Plan** - DBED - Energy Division, or the new energy agency, should prepare an energy conservation plan with specific programs and policies to achieve measurable objectives, including recommendations for reducing the dependence of the transport sector on imported petroleum products.

- **Energy Emergency Preparedness Plan** - DBED - Energy Division, or the new energy agency, should update the EEP plan biennially. The plan should include the most up-to-date county energy emergency management plans.

To support the HEP process, the following task forces and committees will be created and maintained:

- The **EPAC** should be maintained to support the policy development activities of the proposed new energy agency. The ERC should continue to serve as the Chairman of the EPAC.

- An **IRP Task Force** should be established (as discussed during the PUC IRP proceedings). The IRP Task Force should review and provide input to the Energy Conservation Plan and Long-Range Energy Supply/Demand Forecasts.

- The **EREDH Task Force** should remain as a standing task force. EREDH Task Force subgroups should be formed and changed to reflect the EREDH Task Force's areas of focus, e.g., building energy use and environmental/land-use regulations. The EREDH Task Force should review and provide input to the Comprehensive Research, Development and Commercialization Strategy.

- A **Transportation Task Force** should be formed with representation from DOT, county planning agencies, and from the federal government, as appropriate, companies that maintain corporate fleets and others. The Transportation Task Force should review and provide input to the transportation and fuels component of the Long Range Energy Supply/Demand Forecast, the Comprehensive Research, Development and Commercialization Strategy, and the Energy Conservation Plan.

- The **Governor's Energy Emergency Preparedness Advisory Committee Issues Subcommittee** should continue to identify energy emergency issues and to recommend actions and plans that address and resolve these issues.

5.3 SCHEDULE AND RESPONSIBILITIES

The ERC, or Director of the new energy agency, will have the lead responsibility for initiating the HEP Program. A list of the task force members will be prepared and staff will be assigned the responsibility for preparing the components of the Hawaii Energy Plan. The ERC is also responsible for analyzing the effectiveness (both impact and implementation) of policies that were adopted in the previous Hawaii Energy Plan.

The HEP Process will be a two-year effort culminating in the submission of the Hawaii Energy Plan to the Governor, Legislature and general public. During the first year, the components will be prepared. They will be integrated during the second year. Consultants will be hired, as necessary, to support the DBED - Energy Division, or the new energy agency, in preparing the Hawaii Energy Plan.

5.4 POLICY DEVELOPMENT, IMPLEMENTATION AND EVALUATION

The preparation of this HEP Report, and subsequent Hawaii Energy Plan, represents a milestone in the integrated energy policy development process. The activities leading up to the report, as well as those that follow, will be instrumental in the successful implementation of the reports' policy recommendations.

The policy evaluation process adopted for the HEP Program consists of five sequential steps occurring over a two-year period (see Exhibit 23). Each iteration of the development, evaluation and implementation process would end with the needs assessment described in Step 1. The five steps in the HEP evaluation process are:

- **Step 1: Needs Assessment** - At the beginning, the energy policy stakeholders/constituencies are identified for each of the task forces; participants provide input and categorize policy needs according to issue area (e.g., electric utility planning).

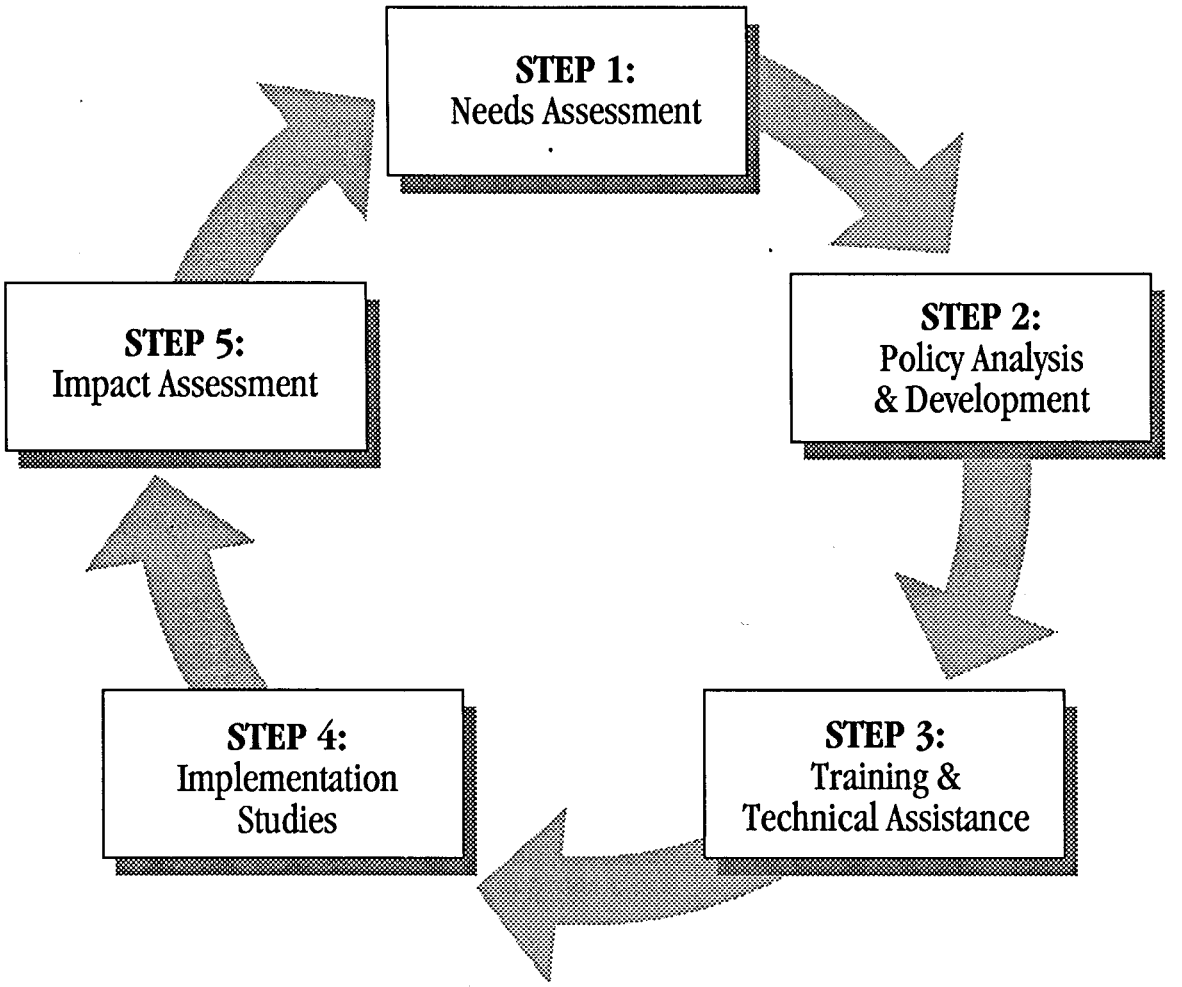
- **Step 2: Policy Analysis and Development** - This step consists of reviewing existing policies and programs in Hawaii, identifying models from other jurisdictions, projecting the impact of policy alternatives, and adopting policies that best meet energy objectives.

- **Step 3: Training and Technical Assistance** - At this stage, guidelines and implementation procedures are developed for each of the adopted policies. It also includes a determination of institutional requirements, such as capabilities and funding.

- **Step 4: Implementation Studies** - This step looks at the parameters for success, i.e., what are the variables for successful implementation and what factors threaten the implementation?

- **Step 5: Impact Assessment** - The last step in the process is intended to compare the actual with the expected level of performance of a given policy. This exercise consists of selecting performance measures or criteria, quantifying relevant impacts, comparing results with program goals, and suggesting ways to improve the overall program performance.

EXHIBIT 23: Design of an Energy Policy Evaluation Process



SECTION 6: INDEX

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SECTION 8: GLOSSARY OF TERMS AND ABBREVIATIONS

ACID RAIN - Acidity in rain is produced when carbon, nitrogen and sulfur compounds oxidize in the atmosphere.

ALCOHOL FUEL - A class of liquid chemicals that have certain combinations of hydrogen, carbon and oxygen, and that are capable of being used as a substitute or blend with gasoline.

BARREL (OF OIL) - A volumetric unit of measure for crude oil and petroleum products equivalent to 42 U.S. gallons. One barrel of oil has an energy content of 6 million British Thermal Units.

BIOMASS - Energy resources derived from organic matter. These include wood, waste and other living-cell material that may be converted into gaseous, liquid or solid fuel.

BTU (BRITISH THERMAL UNIT) - A standard measure of heat content in a substance that can be burned to provide energy, such as oil, gas, or coal. One Btu equals the amount of energy required to raise the temperature of one pound of water one degree fahrenheit. A Btu is equivalent to burning one match stick.

COGENERATION - Production of heat energy and electrical or mechanical power from the same fuel in the same facility.

COMBUSTION - Burning solid, liquid or gaseous fuel. Rapid oxidation, with the release of energy in the form of heat and light.

COMMERCIAL SECTOR - Non-manufacturing business establishments, including hotels, motels, restaurants, wholesale businesses, retail stores, laundries, and other service enterprises, health, social; and educational institutions, and Federal, State and local government.

CONSERVATION - Steps taken to cause less energy to be used than would otherwise be the case. These steps may involve improved efficiency, avoidance of waste, reduced consumption, etc. Energy conservation usually results from changes in current activity (e.g., turning the lights off), while energy efficiency involves the introduction of new technologies (e.g., household appliances). See energy efficiency.

CONSTANT DOLLARS - Past or future dollars converted to the value of a dollar in a given year in order to eliminate the effect of inflation. Also, referred to as "in real terms."

CRUDE OIL - Petroleum in its natural unprocessed, unrefined state which is a mixture of thousands of different hydrocarbons - compounds of hydrogen and carbon. The mixture varies slightly from one oil field to another.

DBED - Hawaii Department of Business, Economic Development and Tourism

DCCA - Hawaii Department of Commerce and Consumer Affairs

DEFACTO POPULATION - The resident population plus the average number of tourists, less absent residents.

DEMAND - The level at which electricity or gas is delivered to users at a given point in time. Electric demand is expressed in kilowatts. Also referred to as load, e.g., load management.

DHW - Domestic Hot Water

DLNR - Hawaii Department of Land and Natural Resources

DOT - Hawaii Department of Transportation

DSM (Demand Side Management) - Utility programs that are intended to alter consumers' demand for electricity, in terms of level, timing or both. (see Load Management)

EEP - Energy Emergency Preparedness

EMISSIONS - Gases and particulate that are discharged into the environment.

ENERGY EFFICIENCY - The percentage of the total energy content of a fuel or energy source that is converted into useful services (e.g., light, motor drive, refrigeration). The remainder is lost to the environment as heat.

ENERGY INTENSITY - The total amount of energy used per dollar of output produced by a given sector or the economy as a whole.

ENERGY RESERVES - The portion of total energy resource that is known and can be recovered with presently available technology at an affordable cost.

ENERGY RESOURCES - Every primary natural resource that can be used by society as a source of energy. Conservation and energy efficiency are considered energy resources, in that they free up additional energy for other uses without reducing the level of service.

EPAC - Energy Policy Advisory Committee

ERC - Energy Resources Coordinator

EREDH - Enhancing Renewable Energy Development in Hawaii (Task Force)

ETHANOL - An alcohol produced upon the fermentation or acid hydrolysis of grain and other organic material (e.g., sugarcane). Ethanol can be used as a motor fuel.

FEEDSTOCK - Solid or liquid material that can be converted into useful fuel sources. For example, plastics are a feedstock for waste-to-energy facilities.

FORECASTING - The methodical estimation of how much energy consumers will need over a specified timeframe or "planning horizon."

FOSSIL FUELS - Fuels that originated from the remains of plant, animal and sea life of previous geological eras. Crude oil, natural gas, and coal are examples of fossil fuels.

FUEL CELL - A devise that converts the chemical energy of fuel directly into electricity. The fuel cell does not burn the fuel and does not produce steam. It uses an electrical process that causes hydrogen atoms to give up their electrons, thereby creating an electric current.

GAS - Gaseous fuel that is burned to produce heat energy. The word is also used colloquially, to refer to gasoline.

GASCO - The Gas Company

GAS UTILITY - A publicly or privately held firm engaged in the distribution and retail or wholesale sale of natural gas within a specified geographic area.

GENERATING STATION - A power plant.

GENERATION - The process of producing electric energy by transforming other forms of energy into electricity; also, the amount of electric energy produced, expressed in kilowatt-hours.

GEOTHERMAL ENERGY - Natural heat from within the earth, captured for production of electric power, space heating or industrial steam.

GREENHOUSE EFFECT - The heating effect of the atmosphere upon the earth. Light waves from the sun pass through the air and are absorbed by the earth. The earth re-radiates this energy as heat waves that are absorbed by the air; specifically by carbon dioxide. The atmosphere thus behaves like a greenhouse.

GROSS NATIONAL PRODUCT (GNP) - A comprehensive measure of aggregate economic activity. GNP measures the value of final goods and services produced in one year, eliminating intermediate products consumed in the production of end products. Because the use of energy is so intimately bound to economic activity, a forecast of GNP is necessary for forecasting energy demand.

(GSP) GROSS STATE PRODUCT - The total value of goods and services produced by the state's economy before deduction of depreciation charges and other allowances for capital consumption in one year.

HAWAII STATE PLAN - Chapter 226 of the Hawaii Revised Statutes. It is intended to guide the future long-range development of the State.

HEAT PUMP - A type of reverse-cycle air conditioner that can use the heat released (or absorbed) when a working fluid changes phases (vaporizes or condenses). The most typical application in Hawaii is for water heating.

HECO - Hawaiian Electric Company

HEI - Hawaiian Electric Industries, Inc.

HELCO - Hawaii Electric Light Company

HEP - Hawaii Integrated Energy Policy

HNEI - Hawaii Natural Energy Institute

HRS - Hawaii Revised Statutes

HYDROELECTRIC POWER - Also, hydropower. Electricity generated by an electric power plant whose turbines are driven by falling water.

IG - Integration Group

IMPLEMENTATION (ACTION) PLANNING - Developing and documenting the detailed steps required to realize the supply- and demand-side resources identified in the integrated resource plan.

IMPORTS - Energy that is transported to Hawaii from outside the islands. Hawaii imports oil from both foreign and domestic sources.

INDIGENOUS ENERGY RESOURCES - Power and heat derived from sources native to a given area. In Hawaii, these include geothermal, hydro, biomass, solar and wind energy.

INDUSTRIAL SECTOR - Manufacturing, construction, mining, agriculture, fishing, and forestry establishments.

INTEGRATED RESOURCE PLANNING (IRP) - The continuing process of developing, implementing, monitoring, and evaluating a utility resource plan that identifies an optimum mix of energy resources for meeting forecasted levels of consumer energy needs, after consideration of all reasonable supply- and demand-side resources in concert with resource planning objectives.

INTERCONNECTION - The linkage of transmission lines between two utilities, or between a non-utility generator and an utility.

IRC - Inter-Agency Role Clarification (Task Force)

IRP - Intergrated Resource Planning

KILOWATT (kW) - One thousand watts. A unit of electric capacity or power.

KILOWATT-HOUR (kWh) - One thousand watt hours. A unit of electricity consumed or generated.

LIQUIFIED PETROLEUM GAS (LPG) - A gas containing certain specific hydrocarbons which are gaseous under normal atmospheric conditions, but can be liquified under moderate pressure at normal temperatures. Propane and butane are the principal examples.

LOAD MANAGEMENT - (see DSM) Actions taken by the customer or by the utility to affect the normal demand of electricity (amount or timing), principally to reduce power demand during peak load (demand) periods or shift some of it to off-peak periods. Load management may be pursued by persuading consumers to modify behavior of by using equipment that regulates some electric consumption.

MECO - Maui Electric Company

MEGAWATT (MW) - 1000 kilowatts or 1 million watts. A unit of electric capacity or power.

MEGAWATT-HOUR (MWh) - 1000 kilowatt hours or 1 million watt hours. A unit of electricity consumption or production.

METHANE - A light hydrocarbon that is the main component of natural gas and gas produced from the anaerobic digestion of organic matter.

METHANOL - A light, flammable alcohol having four parts hydrogen to one part each of carbon and oxygen. Methanol can be used as a motor fuel.

MONITORING AND EVALUATION - The process of capturing and analyzing data and drawing conclusions about the performance of supply- and demand-side resources.

MUNICIPAL SOLID WASTE - Locally collected garbage or refuse, which can be processed and burned to produce electricity.

NATURAL GAS - A naturally occurring mixture of hydrocarbon and non-hydrocarbon gases found in porous geological formation beneath the earth's surface, often in association with petroleum. The principal constituent is methane.

NELHA - Natural Energy Laboratory of Hawaii Authority

NOx - Nitrogen Oxides - A product of combustion of fossil fuels whose production increases with the temperature of the process. It is considered an air pollutant if concentrations are excessive.

OPEC - The acronym for the Organization of Petroleum Exporting Countries, that have organized for the purpose of negotiating with oil companies on matters of oil production, prices and future concession rights. Current members are Algeria, Ecuador, Gabon, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, and Venezuela.

OTEC - Ocean Thermal Energy Conversion - A technology or process for converting the temperature difference of cold deep ocean waters and warmer surface waters to produce electricity in either an open (flash) cycle, or closed (binary) cycle.

PICHTR - Pacific International Center for High Technology Research

PRI - Pacific Resources, Inc.

PVE - Petroleum Violation Escrow account

PROPANE - A gaseous paraffin hydrocarbon, occurring in crude oil, natural gas, and refinery cracking gas. It is used as a fuel, solvent and refrigerant.

PEAK LOAD - Also, peak demand. The highest electrical demand on the utility system. The level of demand or load that utility generating capacity is designed to adequately meet.

PHOTOVOLTAIC (PV) CELL - A solar energy conversion device that changes photons (light energy) directly into electrical energy. PV systems are usually installed in panels of varying sizes.

POWER PLANT - A central station electric generating facility.

PUC - Hawaii Public Utilities Commission

QUAD - One quadrillion British thermal units (Btus). An amount of energy equal to 170 million barrels of oil.

R & D - Research and Development

REFINERY - A facility that separates crude oil into varied oil or petroleum products. The refinery uses progressive temperature charges to separate, by vaporizing, the chemical components of crude oil that have different boiling points. These are distilled into usable products such as gasoline, fuel oil, and kerosene.

RETROFIT - Adding equipment to an existing facility or building after construction has been completed.

RENEWABLE ENERGY - A class of energy sources, such as solar, wind, hydro and biomass, whose supply is continuously or periodically renewed.

RESOURCE ASSESSMENT - The identification and characterization of all reasonable resource options for meeting consumer energy needs.

RESOURCE OPTIMIZATION - The integration, balancing and ranking of supply- and demand-side resources such that consumer energy needs are met at the least cost, consistent with integrated resource planning objectives.

RESIDENTIAL SECTOR - Private household establishments, which consumes energy primarily for lighting, water heating, air conditioning and operating appliances. Includes all single and multi-family establishments, but not temporary housing such as hotels.

RPR - Regional Petroleum Reserve

SMPG - Seat Miles Per Gallon

SNG - Synthetic Natural Gas

STRATEGIC PETROLEUM RESERVE (SPR) - Petroleum inventories maintained by the federal government for use during periods of major supply interruptions. The SPR is located in Louisiana and Texas.

SULFUR DIOXIDE (SO2) - Heavy, pungent, toxic gases released when fuel containing sulfur is burned. A major cause of acid rain.

SWECS - Small wind energy conversion systems

SOLAR DOMESTIC HOT WATER - Solar collector installed to provide the hot water demands of homes and commercial establishments.

THERM - A unit of heating value equivalent to 100,000 British thermal units; 1 therm equals 100 cubic feet of natural gas.

THERMAL - Heat energy, used directly or converted into electric energy.

TRANSPORTATION SECTOR - Private and public vehicles that move people and commodities, including automobiles, trucks, buses, motorcycles, railroads and railways, aircraft, ships, barges and non-motorized transport.

TRANSMISSION - Transporting bulk power over long distances.

USDOD - U.S. Department of Defense

WAVE ENERGY - The conversion of the kinetic energy contained in ocean waves into useful energy, usually through the use of a hydraulic system.

APPENDIX 1

INTEGRATION GROUP

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Energy Division

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President and CEO
Pacific International Center for
High Technology Research

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Chevron Marketing of Hawaii

Mr. Peter Garcia
Property Manager
Department of Transportation

Mr. Kelvin Kai
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Citizens Utilities Company
Kauai Electric Division

Mr. Leslie Matsubara
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System Planning Department
Hawaiian Electric Company, Inc.

Dr. Victor Phillips
College of Tropical Agriculture
and Human Resources
University of Hawaii

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Vice President
GASCO, Inc.

Mr. Henri Tsuyemura
Adminstrative Director
Public Utilities Commission

APPENDIX 5

GOVERNOR'S ENERGY EMERGENCY PREPAREDNESS ADVISORY COMMITTEE

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Director
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Economic Development & Tourism

The Honorable Robert Alm
Director
Department of Commerce
and Consumer Affairs

Mr. George E. Bates
President
GASCO, Inc.

Mr. Richard S. Botti
Executive Director
Hawaii Automotive Retail
Gasoline Dealers' Association

Mr. Fred Devereux
District Manager
Unocal Corporation

The Honorable Edward Y. Hirata
Director
Department of Transportation

Mr. Maurice H. Kaya
Energy Program Administrator
Department of Business,
Economic Development & Tourism
Energy Division

Mr. George Kekuna
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Oahu Civil Defense Agency
City and County of Honolulu

Mr. Harry Kim
Administrator
Civil Defense Agency
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Mr. Kal Kobayashi
Energy Program Specialist
Energy Extension Service
County of Maui

Mr. Eddie Lapa
President, Local 142
International Longshoremen's
and Warehousemen's Union

Mr. Tom Malone
President & CEO
Aloha Petroleum, Ltd.

Mr. George Meldrum
Area Manager
Texaco Refinery and Marketing, Inc.

The Honorable Yukio Naito
Chairman
Public Utilities Commission

Mr. Russell K. Okata
Executive Director
Hawaii Government Employees
Association

The Honorable Warren Price III
Attorney General
Department of the Attorney General

Mr. Dennis S. Reeves
Vice President, Planning
Pacific Resources, Inc.

Major Gen. Edward V. Richardson
Adjutant General
Department of Defense

The Honorable Winona Rubin
Director
Department of Human Services

Mr. Glenn Sato
Acting Director
Department of Economic Development
County of Kauai

Dr. John W. Shupe
Director
Pacific Site Office
U.S. Department of Energy

Mr. Jack T. Vaughan
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Shell Oil Company

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Hawaiian Electric Company, Inc.

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Regional Marketing Manager
Chevron U.S.A., Inc.

Committee Resource:

Dr. John Tantlinger
Energy Planner
Department of Business,
Economic Development & Tourism
Energy Division

APPENDIX 6

PARTIES TO THE PUC DOCKET NO. 6617

Hawaiian Electric Company
Maui Electric Company
Hawaii Electric Light Company
Citizens Utilities Company, Kauai Electric Division
The Gas Company
GASPRO
Department of Commerce and Consumer Affairs
Department of Business, Economic Development & Tourism
Department of Health
Department of Land and Natural Resources
Office of Hawaiian Affairs
U.S. Department of Defense
City and County of Honolulu
County of Kauai
County of Hawaii
County of Maui
Pacific International Center for High Technology Research
Hawaii Sugar Planters' Association
Hawaii Energy Coalition
Natural Resources Defense Council
Big Island Rain Forest Action Group
Blue Ocean Preservation Society
University of Hawaii Rain Forest Action Group
Pele Defense Fund
Puna Geothermal Ventures
Building Owners and Managers Association of Hawaii

APPENDIX 7

SUMMARY OF COMMENTS FROM HEP PUBLIC REVIEW MEETINGS *
(July 30 through August 15, 1991)

Introduction

This is a summary of the group memories recorded at the six meetings held statewide concerning the draft Hawaii Integrated Energy Policy Development Plan. The full text of all group memories can be found in the Technical Annex. This summary brings to the forefront those thoughts and concerns that were voiced over and over by the various communities. Many specific suggestions that were made at one meeting or another may be found in the Technical Annex and this summary should not be construed as a full account of all comments made. The HEP report has been revised to reflect many of the comments found in the summary.

In general, the document was favorably received by the public, although there was a more than healthy degree of skepticism that the recommendations would actually be implemented or acted upon. The skepticism arises from the fact that the public has seen little positive improvement on the part of the state in the promotion of conservation and renewable energy sources under DBED's control. The public raises many questions about DBED's willingness to aggressively pursue and implement necessary actions to put the State on the road to energy self-sufficiency. The public especially perceives an inherent conflict with its charge to promote economic development including tourism and the fact that tourism is an energy intensive industry.

The community was clear in its feeling that conservation is an integral part of any energy planning exercise and was not afforded sufficient visibility or discussion in the document. A separate section dedicated to conservation is needed in the report. Conservation as an adjunct to renewables will assure that it does not get the attention it deserves or reach the potential that is possible in energy savings for the State. An aggressive conservation program was seen as essential to many of the participants.

The public felt that government should become the leader and set an example in the areas of energy conservation and efficiency. They liked what they saw in the report but felt it did not go far enough. They felt that all public buildings (State, County and Federal) should be retrofitted and become the examples for private enterprise on energy efficiency. They also felt that providing the energy savings information in dollars to private enterprise would act as an incentive for industry to follow suit.

As mentioned earlier there is a fear that this policy report will go nowhere. The lack of specificity and an implementation strategy or action plan were sited as signs that the report was intended to appease the public and change very little in the way the state does business. The tendency of the plan to focus on large renewable energy systems rather than discuss and provide for incentives for the development of decentralized individual systems was noted many times as an indication that the State would continue to pursue big business as usual.

Self-sufficiency should be looked at on an island-by-island basis recognizing that the neighbor islands should be able to achieve a high degree if not complete self-sufficiency but that it is doubtful that Oahu ever will. There is resistance on the neighbor islands to have large scale renewable energy development to Oahu. Each island should solve its own energy supply needs. There was also support for a system of self-sufficiency loans. These would be low interest loans made available to individuals to develop and implement decentralized individual energy self-sufficiency systems.

Most of the neighbor islands expressed their concerns about geothermal and the way the State has handled this development. They felt that this was an example of how not to proceed to develop renewable energy sources. It was

* Prepared by Center for Alternative Dispute Resolution

felt that public input was circumvented and that rights due process were trampled. The comments also concerned whether or not geothermal was a renewable energy source or just an alternate one and urged that some determination in this area be made.

Coupled with the comments on geothermal as well as being stated independently was the need to provide systems to adequately monitor permit compliance and perform enforcement and regulatory duties. Many members of the public see this as the weakest link in guaranteeing the safe development of energy resources from an environmental and public standpoint.

The community was pleased to see the inclusion of transportation energy needs in the report. They felt that greater attention should be paid by the State to public transportation needs of the neighbor islands. Transportation technologies chosen should also be assessed on the basis of energy conservation and the degree to which they can use alternate forms of energy. It was felt that alternate fuels could reduce Hawaii's dependence on oil as well as stimulate agricultural industries and should be more aggressively pursued by the State. The State, County and Federal governments should convert their fleets to alternate fuels as an example to private industry. The public also felt that an aggressive system of incentives and disincentives aimed at encouraging use of alternate fuels and methods of transportation should be implemented.

The majority of comments favored educational programs aimed at both the schools and the general public, however, a cautionary note was raised that they be educational in nature and not have the bias of indoctrinating persons to State programs. To be truly educational, they should fairly present all sides of energy issues.

The participants felt that DBED had improved in public involvement in their planning processes but that more meaningful public involvement needed to take place earlier in the process and that a constant feedback loop for public input was needed.

In conclusion, the communities are pleased with the perceived changes in DBED's attitude toward public input in general and the direction of this policy document. However, they want to see a lot more action and implementation, including alternatives that favor decentralization and individual self-sufficiency, before they will be convinced that the State is on the right path.

Major Group Memory Comments

What follows is a listing directly from the group memories (contained in the Technical Annex) of major issues raised repeatedly at various public meetings. The issues are listed under the headings of Policy and Planning, Transportation, Energy Emergency Preparedness and Enhancing Energy Efficiency and Renewable Energy Development. It was noted by the public that the following recommendations need to be consistent and either start with "The State" or "Hawaii" but not jump back and forth between the two terms.

Policy and Planning

Five institutional options were presented to the public:

- Enhanced Status Quo (DBED Energy Division)
- Division of Public Utilities Commission
- Hawaii Energy Commission
- Governor's Office of Energy
- Department of Energy

Options four and five received the greatest amount of support from the community. Concerns and comments heard most often were:

- the need to do away with areas of overlap among departments in the design of any system
- the need to transfer all energy functions from other departments to whatever new structure is established
- the need to look at an Energy/Environment Department to recognize the impact of one on the other
- the need to provide deadlines and maximum action times on permit processes
- the need to assure that regulations are administered and enforced
- the need to provide more emphasis on conservation
- the need to provide for fair representation of all counties on any energy policy-making board
- the need to provide for a high degree of accountability to the public
- the need to not create another layer of government; if option cannot reduce bureaucracy, it should not be pursued
- the public needs to be included in the Policy Advisory Committee
- do what gives energy the highest priority and can be accomplished relatively quickly
- Policy Advisory Committee needs to have clout
- the need to include preferred focus (i.e., energy efficiency and conservation) as department is formed
- new entity should reduce barriers to implementation of renewables and conservation

Hawaii should develop the capability to conduct long-range integrated energy planning, with specific components on electricity generation and consumption as well as transportation (air, marine and ground) energy use.

- planning should be long-range and visionary at least 20 years (30 years)
- reconciliation of forecasts and outcomes needs to happen to fine tune process
- should include conservation
- add long range language emphasizing "sustainability of life on the Hawaiian Islands"
- need to define "develop capability"
- need mechanisms to change policies
- any data gathered should be available and accessible to the public through the library system
- integrate military into planning but look at separately
- need to deal with both utilities and non-utilities
- need to look at demand as well as supply side of all uses
- change "electric" utilities to "energy" utilities and energy "companies" to "entities"
- data base should include successful alternative energy systems and projects

Hawaii should institutionalize the HEP process.

- there was some support for institutionalizing the HEP but the major concern was that continuous and meaningful avenues for public input into energy policy be provided for
- public input must come even earlier in the process and include continued access during the process
- need to provide infrastructure for the integration of a community planning process with government and industry
- need to make sure public is educated to participate effectively in process

Hawaii should amend the Hawaii State Plan, HRS Section 226-18, to include an additional objective to "enhance energy security" and an additional policy to "promote alternate fuels and energy efficiency by encouraging diversification of transportation options and infrastructure."

- there was community support for this option
- should look at all potential biomass crops to help in this area, including hemp
- the word "enhance" should be replaced with "ensure"

- add alternative energy fuels and sources
- enhance tax breaks and incentives for those using alternative energy sources
- surcharges for energy use in other areas such as water and sewerage pumpage should be quantified and noted for the consumer
- economic value of alternative energy should be reviewed
- look at neighbor islands differently, they have needs different from Oahu; should look at self-sufficiency on an island-by-island basis
- look at sustainable growth
- need more promotion of alternate energy fuels

Hawaii should conduct an analysis of the macroeconomic impacts of oil supply disruptions and/or sharp increases in oil prices.

- change macro to micro and look at economic development scenarios
- should also be used as an educational program

Hawaii should establish a range of institutional mechanisms to aid resolution of disputes among energy stakeholders.

- all stakeholders should be afforded equal weight in any process
- process should not replace existing rights and processes and should be voluntary
- IRP collaborative is a good process and encourages cooperation
- need more specificity on types of processes
- permitting lags and the reality of bureaucratic red tape needs to be addressed

Hawaii should analyze the internal/external costs and benefits of different energy resources and technologies appropriate for Hawaii.

- utility should prepare tier costs that vary according to the energy conservation strategies pursued by the customer
- need more education on what external costs are; how consumers pay in terms of environmental costs
- explore load shifting
- need to add regulatory oversight and permit enforcement
- encourage public participation in all forms of energy conservation
- need for inclusion of long-term costs that can be quantified.

Transportation

The State should analyze the energy impacts of proposed approaches to relieve congestion, particularly in the Honolulu business district and surrounding areas.

- should follow criteria used for City transit model (energy use per passenger mile)
- bicycles and pedestrian modes of travel are overlooked
- needs specific goals and timetables
- need to look at Neighbor Island needs, not just Oahu, and plan for their unique needs
- look at incentives rather than disincentives
- need to focus planning on reducing use of energy
- look at land use planning as it impacts transportation energy needs
- look at canceling State/County parking permits
- require rental fleets to use alternate fuels
- should look at energy efficiency of any system
- look at vehicle tax and design it to encourage the most efficient vehicles
- neighbor island needs, need just as high a priority as Oahu

State, county and federal government should engage and coordinate demonstration of alternate fuel and energy efficient vehicles.

- — fuel tax should be dedicated to alternate energy
- — vehicles exist that can utilize alternative fuels; let's not demonstrate but require their use by governments
- — should include air and water transportation, not just ground
- — needs more specificity (i.e., list fuels, photovoltaics, and electric and hydrogen cars)
- — need to look at alternate fuel as they help the sugar industry
- — add incentives to encourage use of more efficient vehicles
- — change "demonstration" to "implementation"
- — look at incentives which encourage individual and private business fleets to convert to alternate energy
- — tax credits for efficiency

The State should support and promote decentralization of private and public services through use of telework centers and satellite office facilities.

- — need to create incentives for private industry to encourage telework
- — need to identify state agencies that can relocate geographically
- — need to involve federal and county governments
- — need to look at work at home situations
- — look at the fuel implications of increasing airports capacity and size
- — use telecommunications for educational activities
- — consider using HITS or teleconferencing for public meetings

The State should assist the counties of Maui, Kauai and Hawaii in the planning, assessment, development, and/or improvement of public transportation systems.

- — should encourage State financial support or county programs, but the State should not take authority for development of programs
- — look at rail system for neighbor islands; State should help expand or establish neighbor island bus systems
- — look at all alternatives (taxis, jeepneys, etc.)
- — look at legalizing hitch hiking with a certification or ID card for hitch hikers
- — add State help to counties in the area of financing

The State should establish commuter information centers to facilitate commuter ridesharing for government, communities, schools, businesses and hotels/resorts.

- — convert the city, state, county vehicle fleets to use alternate fuels as a prototype for the private sector (Portland operates public transportation on hydrogen fuel)
- — look at capping number of cars
- — build more bike paths and ways
- — need to set specific goals, by a certain year, x % of cars will be electric
- — should be done on county level
- — state should establish a parking tax that will be earmarked to subsidize public transportation in the county it is based
- — create work where people live
- — establish pick-up stations for pedestrians
- — provide modem access to database

Energy Emergency Preparedness

(This section was the most confusing for the public to comment on as the material was the least familiar to the public.)

Hawaii should develop and implement changes to the State's Energy Emergency Preparedness (EEP) Statute (Chapter 125C, HRS).

- support for this
- State EEP needs to take a more pro-active role in the areas of oil spills and hazardous waste
- plan needs to be centralized and provide for decentralized execution
- need to coordinate with the Federal government
- question need for full-time staff
- include provisions and guidelines for accelerated development of renewables

Hawaii should revise State Administrative Rules (Section 91, HRS) governing the State Fuel Set-aside Program to: (1) accommodate otherwise eligible commercial accounts that do not posses requisite 12-month base period account history, and (2) permit priority certification for emergency services and certain other essential users to obtain fuel without applying through the State Fuel Set-aside Program during a fuel shortage.

- support for this
- State and counties need strong Civil Defense communication infrastructure
- price of potential shortages should be integrated into the cost of gasoline at the pump
- specify who "other essential users" are and prioritize

Hawaii should review current petroleum product specification laws to determine which, if any, are applicable to a waiver of key product specifications to increase energy supplies during a petroleum shortage.

- pursue a waiver from the Federal government
- more information on types of products

Hawaii should assess the need to designate aviation fuels as subject to Government controls under the State Fuel Set-Aside Program.

- if commercial planes are used for military purposes, then the planes should be fueled from military reserves
- need to look at neighbor island evacuation needs
- airline industry needs to be involved
- consider ship fuel in the set-aside program

Hawaii should establish a 10 million barrel (90 day supply) Regional Petroleum Reserve (RPR) in Hawaii.

- need public input to RPR location(s)
- should consider decentralized storage facilities
- EEP should consider stock piling renewable energy resources, factor this into the planning process, consider solar, biomass, other alternative energy storage technologies
- private sector should be on Governor's EEP committee
- change the word "petroleum" to "fuel"
- RPR should be divided between the neighbor islands and strategy should include handling, storage and transportation concerns

Hawaii should pursue a strategy to obtain "priority access" to SPR oil for Hawaii in the event of a petroleum supply disruption, until a RPR can be established in Hawaii.

- some support
- EEP should include a comprehensive energy plan with an aggressive conservation element to stretch any available reserves

Enhancing Energy Efficiency and Renewable Energy Development

Hawaii should develop a comprehensive energy research and development (R&D) program with specific resource development, basic and applied research, and commercialization activities.

- support for this
- recommendation should read, "Hawaii should develop, coordinate and disseminate a comprehensive energy research and development..."
- counties need to be given a more active role in the process
- look at funding for individual research
- contests in specific areas; offer cash awards or incentives
- separate section conservation
- biomass gasification needs own section on fuel production
- to determine whether geothermal is renewable

Hawaii should establish a data base of information upon which to analyze renewable energy options.

- database needs to be accessible to the public
- look at existing information in other areas and incorporate, do not reinvent the wheel
- provide incentives to individuals to record and collect data
- establish long-term wind monitoring stations in appropriate areas
- consider tree plantations as energy reserves
- need larger budget for renewables
- add energy efficiency, need specific suggestions, incorporate the IRP needs, need end use data collection and coordination of DSM data between islands and utilities

Hawaii should establish guidelines/standards for renewable energy installations.

- support for this
- need to go through a public process on proposed guidelines
- make sure guidelines work with existing rules and regulations
- need to be sure that response for violations and regulation and enforcement is in place
- need to check qualifications of individuals working in energy development and implementation
- complete existing standards first (i.e., air standards on geothermal, etc.)

Hawaii should implement the building energy codes being prepared by DBED - Energy Division through hiring building code professionals in each of the Counties.

- State and Counties need to use energy codes at the planning and design end of the process
- need to be able to upgrade codes quickly to accommodate new alternative energies as they come on line
- Counties need to be involved in code development
- be sure it works for the Counties

- develop energy efficient design criteria, provide a variety of energy efficient housing plans for public use
- State should pay for building code specialists

Hawaii should mandate cost-effective use of alternate energy and energy efficient domestic hot water for public housing units.

- broaden to include "lighting"
- should include all housing units, not just public housing
- should also include public buildings
- include condominiums and resorts
- consider tax on old technology
- needs to include both public and private sectors
- need understanding/education that energy efficient homes save money - qualify for lower mortgage, etc. direct impact on lenders/appraisers to eliminate discretion among energy producers
- fund alternatives through disincentives to fossil fuel
- alternative energy devices should be mandatory for all government funded projects

Hawaii should modify license-C classification to allow solar professionals to do complete domestic hot water (DHW) and photovoltaic system installation.

- good idea; overdue
- need to address liability questions

The State should investigate the potential for dual (compatible) use of State-owned agricultural and conservation zoned land for siting renewable energy projects.

- who makes the determination? If it is just the State, it is a problem; need broad public process and input looking at all potential adverse impacts
- need stringent rules, reviews and public input
- contested case hearings should remain in process do not draw conclusions before planning process is complete
- State should rezone/pre-permit areas allowable for renewable energy projects with adequate public input and review of process

Hawaii should assist the county planning departments to develop comprehensive solid waste management plans.

- support for this
- look at hazardous waste also
- look at strategy of waste minimization: Reduce/Reuse/Recycle

Hawaii should identify and designate streams and river basins that are acceptable for hydropower development.

- needs a large element of public input, and environmental impacts must be assessed
- question of economic viability on any local stream
- prioritize all energy projects considering all elements of uses
- change "acceptable" to "suitable"

Hawaii should launch a major statewide energy education program complete with public service announcements, demonstrations, technical and general curricula for local schools, fact sheets, etc.

- general support for this
- State and Counties should become models of the best energy efficiency and conservation methods
- should be aimed at general public as well as schools
- need to educate decision makers
- utility bill should include information on how to reduce use
- should include education on self-sufficiency
- more money needs to be allocated
- use systems similar to agricultural extension services to accomplish

Hawaii should develop a comprehensive renewable energy export promotion program to assist Hawaii-based companies to expand their markets to Asia and the Pacific.

- we should deal with Hawaii first; make it a show case for alternate energy technologies before we export them
- should locate companies in depressed areas of high unemployment
- would assist energy efficiency companies
- should assist Hawaii-owned companies not Hawaii-based companies

Hawaii should examine ways to establish and update renewable energy and demand side management preference in utility regulations to reflect the external costs (e.g., environmental costs) avoided by not using traditional fossil fuels.

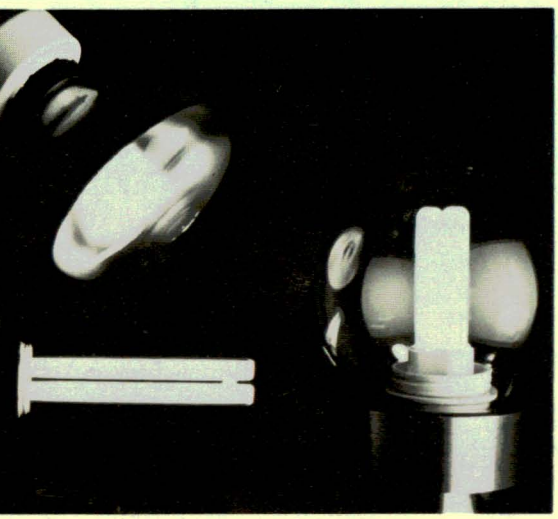
- look at tax credits
- establish a rate structure to allow utilities to share in the savings if they can get their users to decrease demand
- look at rate structure where you pay more if you use more
- make sure neighbor islands are included in discussions
- expedite process to quantify cost to environment; needs to be done now

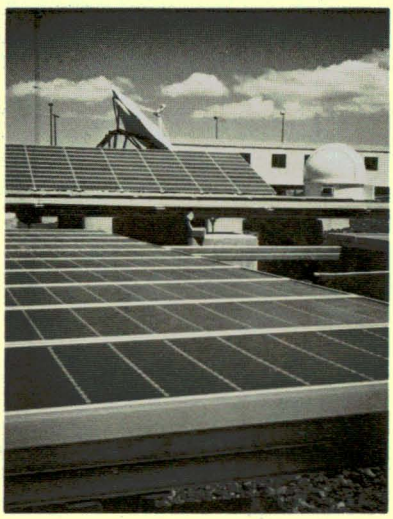
The regulated electric utilities should extend DSM programs to Federal, State and County government facilities.

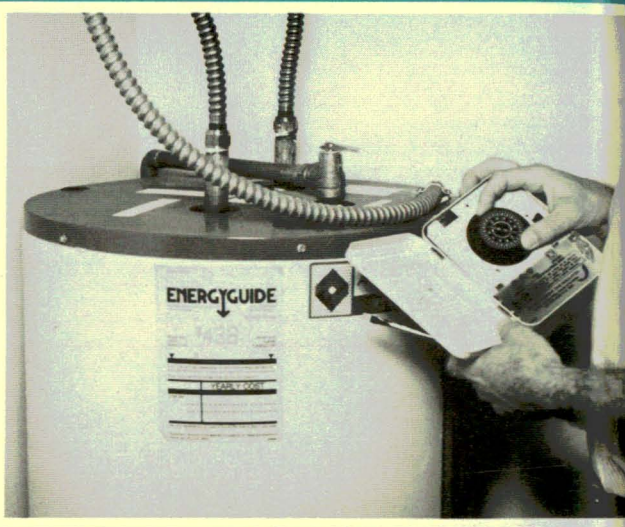
- instead of "electric" use "energy" utilities
- provide for feedback to public with regards to impacts
- need community level individual systems to inhibit overgrowth of utilities

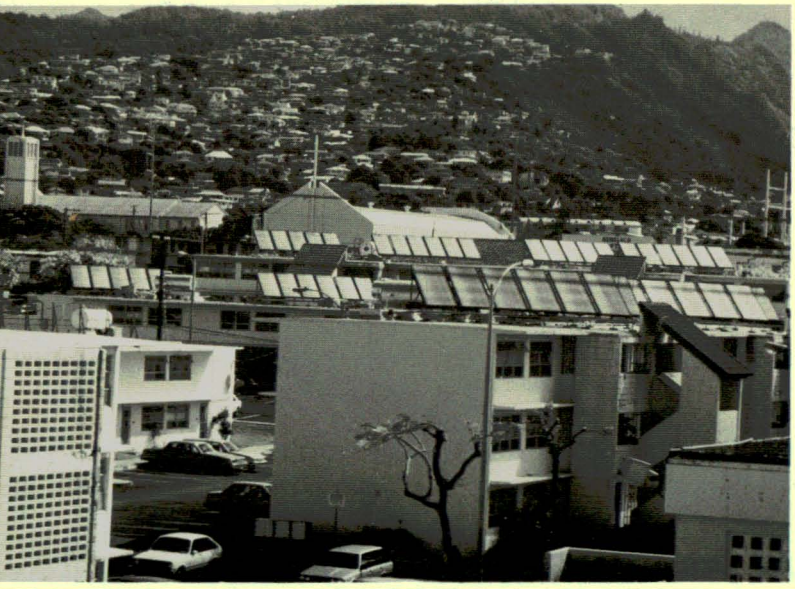
The ERC should assign the responsibility to the DBED - Energy Division, or State energy agency, establish a utility DSM information center.

- ERC needs to go to new structure not stay at DBED
- keep it simple and people efficient
- use agriculture extension model









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